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THE LIVING BIRD QUARTERLY

Summer/1982

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WELCOME...

Dear Member:

I'm delighted to introduce the first issue of *The Living Bird Quarterly.* I truly hope you enjoy this magazine from the Laboratory of Ornithology. It will be coming to you four times each year as a benefit of your membership in the Laboratory.

Our new quarterly follows a long line of *Living Birds* going back to 1962. At that time Dr. Sewall Pettingill, then director of the Laboratory, produced the first *Living Bird* as an annual publication for members. Sewall Pettingill had a special mission in mind for *TLB* which he described in the Laboratory's *Newsletter* that year: "*The Living Bird* will present varied articles, each significant and stimulating. The journal writes neither down to the amateur ornithologist, bird watcher or bird hobbyist, nor writes up to the professional ornithologist or biologist." We intend for our new quarterly to continue in the tradition established by Dr. Pettingill 20 years ago.

The concept of promoting and encouraging the study of living birds is rooted deeply in the mission of the Laboratory. It is embodied in the very name of our publication. Now more than ever we must press forward with our studies of living birds, especially in the face of the increasing demands human populations are imposing upon our environment.

To inform, excite, and challenge you, we are planning articles on virtually every aspect of bird study: behavior, habitat studies, conservation, art, and the latest updates on ornithological research here and around the world.

As members of the Laboratory, this is *your* magazine. We welcome comments, suggestions, and ideas for articles. We know that we can make this a publication for all who are interested in the study of living birds.

Sincerely,
Charles Walcott, *Executive Director*

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FRONT COVERS. Outside—Puffins at Great Island, Newfoundland. Photograph by Stephen Kress.

Inside—A shorebird's time is divided almost equally between earth and sky. Photograph by M. Hopiak.

BACK COVER. Outside—A long-eared owl is quick to defend its nest by assuming a menacing posture. Photograph by J. Hough.

The Reproductive Success of Songbirds

by Raymond J. O'Connor

Birds lead busy lives. Among other things they must learn to fly, find food, build a nest, defend themselves, sleep, grow and reproduce. Like the rest of us they have a finite amount of time and energy to spend on each of life's processes. One of the birds' most necessary functions is reproduction. No matter how vigorous and active a bird is during its lifetime it has not really succeeded unless it leaves descendants to carry on its genes. Because a bird frequently lives on the edge of survival, it sometimes has to choose between saving its own life and saving its offspring. Its lifetime reproductive success is determined by a balance between reproductive effort and its own risk of mortality, sometimes putting more effort into producing eggs, sometimes putting more effort into simply staying alive.

Success is not determined solely by how many eggs it lays in a single clutch. Rather, it is the totality of its breeding efforts over a lifetime, irrespective of whether it rears one enormous clutch and dies immediately afterwards or it achieves moderate success with many smaller clutches spread over its lifetime. The whys and wherefores of these strategies have long fascinated ornithologists. Here I review some of the more important factors which determine how successful a bird is at fledging independent young from its eggs.

Song thrush provides nestlings with glistening earthworms

Photos by David Hosking

Clutch Size

What determines the number of eggs a bird lays? For many years it was thought that clutch size equaled the number of young a pair could feed during the nestling period. This idea — named Lack's hypothesis after the English ornithologist Dr. David Lack who proposed it — remains at the core of our understanding of clutch size in the Temperate Zone. The amount of nutrients and energy a nestling requires limits the extent to which the parents can take on yet another nestling to rear; more young require more feeding and if the parents are already working flat out, the extra young can be fed only at the cost of poorer growth of the existing young.

One way to test the hypothesis is to add extra eggs or nestlings to a nest. If the adults can rear the young from the experimentally enlarged brood they cannot have been operating at their foraging limit. Experiments of this type have been conducted and have shown that, in general, the experimentally enlarged clutches or broods produced no more fledglings than do normal-sized broods. In one species, the red-winged blackbird, *Agelaius phoeniceus*, the adults succeeded in rearing the enlarged brood to fledging by increasing the rate they collected food, but even so, the nestlings each received less food and they fledged at lighter weights. Such underweight fledglings are less likely to survive to enter the breeding population the following year, hence the adults are better off with the normal-sized broods which they can feed adequately.

Adjusting the number of eggs in the clutch allows a bird to match its reproductive effort to its food-collecting abilities, but only roughly, particularly among species with small clutches. For example, a European blue tit, *Parus caeruleus*, laying 10 eggs annually, has the option of a 10 percent increase in clutch size by adding one egg if a particular year looks 10 percent better than normal. However, for the same improvement in food level a song thrush, *Turdus ericetorum*, laying four eggs, must choose between a minimum 25 percent increase (one extra egg) or no increase at all. Thus, reliance on changes in clutch size can result in underuse of available food.

Where such mismatches are regular, the young's rate of growth may evolve to take up the slack: by reducing growth rates slightly a species which could raise optimally, say, 2.8 young, can afford to lay three eggs and raise them more slowly. In fact, growth rates do vary in just the way expected, being very variable among species with clutches of two eggs and progressively less variable among species with larger clutches.

Insurance Schemes

How does a bird determine if it has enough food to feed the clutch? After all, the clutch has to be completed three or more weeks before the nestlings are large enough to run into food shortages. If over the years a female lays a clutch appropriate to the average brood, she can expect to rear too many young in half of her broods and too few in the other half. Playing safe, by laying the minimum number, wastes food she could have exploited, while laying the maximum number risks the loss of the whole brood through starvation.

Two strategies seem to be in use by songbirds to meet this problem. Some species seem very good at predicting food levels. Whether they do this by responding to an environmental cue to which their prey also responds, or whether they can directly assess the amount of food available, we do not know. They do get it right, however, and wind up with about the correct number of nestlings for the food abundance. Other species lack this ability, apparently because they depend on feeding their young on sudden flushes of rather short-lived and unpredictable prey. Such species use a strategy termed brood reduction. Not knowing how many young they eventually can rear, they lay an excess of eggs, but build in adaptations that allow them quickly to starve out any excess nestlings until the brood size matches the food supply.

These adaptations are directed to setting up a competitive hierarchy within the brood and may include: (1) starting incubation before clutch completion, so that early eggs hatch early and start to grow sooner, a habit widespread among birds of prey, such as great horned owls, *Bubo virginianus*; (2) a gradiant in egg size, where large early eggs hatch into large chicks and

Blue tit flies from its nesting hole with a faecal sac in its bill to keep the nest clean

small late eggs into small chicks, as in the European swift, *Apus apus*, and many gulls; (3) fast growth so that early chicks quickly magnify their advantage over later-hatching siblings, a feature demonstrated in house sparrows, *Passer domesticus*, and in several species of raptors and herons.

The strongest young can then secure parental attention by pushing juniors aside. Parents feed the largest chick selectively until it is satisfied, then they feed the next largest, and so on. In this way the later-hatched chicks get little or no food in conditions of scarcity and quickly starve to death.

The Time of Laying

Once they know how many eggs to lay, food-limited species should time their laying to have young in the nest when food for the nestlings is at its maximum. However, not all birds lay at that optimum time of year. Some factor must be acting that stops these individuals from breeding earlier than they do. One such influence is likely to be the seasonal availability of food for laying females at the time of egg formation.

To see how this works, consider a female songbird faced with the approaching breeding season. The low temperatures, short days, and scarce food resources of winter have necessitated that all her energies be devoted to finding enough food to stay alive. As spring develops, however, temperatures rise, the days lengthen, the insect prey begins to appear once more and the female can meet her own energy and nutrient requirements more easily. She can devote resources to breeding activities, first to gonadal growth to enter breeding condition, then to finding a mate and territory, and finally to producing eggs.

Small surpluses of energy suffice for the earlier activities but such is not the case with egg formation. For many small songbirds the eventual clutch may weigh as much or more than the female's own body. To take in the quantities of nutrients required for this task is obviously difficult when food is scarce in early spring. Later, when warmer weather requires lower expenditures of the female's own metabolism and when food is more abundant, the task is easier.

But for many songbirds the longer the female delays laying, the poorer the rearing conditions. Even a three or four week delay makes a difference. In great tits, *Parus major*, in English oakwoods, the young are reared on the seasonal hatch of defoliating caterpillars. Because these insects pupate in the ground, they become steadily scarcer as the season progresses. In some species of hummingbirds a similar scarcity arises over nectar production in flowers.

How can a pair accommodate to this dilemma? One evolutionary adaptation requires the male to assist the female in gathering enough food for her to form her daily egg. This is called courtship feeding. The female frequently interrupts her own foraging to solicit food from the male, using begging postures and calls very much like those seen later in the fledglings. In response, the male departs and returns with a caterpillar or other food item which he presents to his mate. Originally thought to promote a stronger pair bond, such courtship behavior serves an important energetic role. The food brought to the female may approach in energy and nutrient content the amount she needs to lay an egg that day. In the great tit about one-third of the female's daily intake is provided by the male.

If the timing of the breeding season is really determined by egg-laying requirements, one would expect an earlier breeding season if food were to become available earlier. The Swedish ornithologist, Hans Källender, conducted just such an experiment, by providing mealworms within the territories of great tits ahead of and during the laying period. He found that females with access to such food laid up to a week earlier than did females without such access. A similar result was obtained in Scotland when carrion crows, *Corvus corone*, were given winter food supplements. One can conclude that the laying date is determined not by the abundance of nestling food but by the availability of food for egg formation.

One fascinating consequence of this phenomenon is that small birds can breed earlier than large ones. Because a small bird needs less total energy for its own maintenance than does a larger one, it can start diverting energy and nutrients towards egg formation earlier. This is shown strikingly by the laying dates of titmice in Britain: the tiny long-tailed tit, *Aegithalus longicaudatus*, breeds an average of 15 days before the heavier great tit. This effect also occurs intraspecifically, for within the great tit population in Wytham Woods near Oxford, England, small-bodied females lay significantly earlier than larger ones. That this is a direct consequence of energy expenditures on self-maintenance is suggested by the finding that females nesting in well-insulated nest-boxes lay significantly earlier than females in boxes with poorer insulation.

Why do great tit females not evolve a smaller size to allow them to breed earlier and therefore more successfully? One reason is that selection is not determined solely by reproductive success in any single breeding season. Females also have to survive the winter and, because of the nature of their food supply at that time of year, must do so in flocks. In the wintering flocks larger birds are dominant over smaller ones and often supplant them from food finds. In such conditions the smaller females are less likely to survive the winter. This disadvantage certainly balances any advantage being smaller carries in terms of breeding earlier.

Reproductive Commitment and Survival

The notion that reproduction and survival are antagonistic, with trade-offs of one for the other, is a recent but very important one. A bird can increase its chances of success with its current reproductive attempt by investing more heavily in it, but in doing so it reduces its chances of success with future attempts. Species that produce a large number of eggs in a single clutch increase their output of young but do so at the expense of their own survival. Other species produce fewer eggs per clutch but live longer and so are likely to produce more eggs over their lifetime. Another point worth noting is that those species that produce eggs in several clutches during a single breeding season survive better than those producing one clutch containing the same total of eggs.

These trade-offs between survival and reproductive efforts allow some predictions as to how parent birds should behave. For example, a young bird breeding for the first time has a lifetime of breeding attempts before it and should not jeopardize its future for the sake of its first clutch and brood. An older bird, on the other hand, has fewer future breeding attempts and therefore can take more risks with its own life in the current attempt. One thus arrives at the unexpected (for humans) prediction that the young should be cautious and the old more reckless. This does indeed seem to be the case, with young birds often laying only a small clutch and abandoning it to risks relatively readily. Older birds generally lay larger clutches, feed the young more intensively, and defend them more vigorously against predators. (Of course, these effects might be due to experience and not reproductive success.)

One strong piece of evidence that risk-taking and reproductive success are traded within an individual species comes from Dr. David Bryant of the University of Stirling, Scotland, in his study of house martins, *Delichon urbica.* This migrant species builds closed mud nests under the eaves of tall buildings and feeds the young on insects taken in flight from foraging sites near the nest. The first broods are normally in the nest in late June and early July, when aphids are especially numerous in the aeroplankton. But if a second clutch is laid, the young hatch when aphids are scarcer, and larger, more mobile insect prey must be pursued. Even though young from the first brood may assist in feeding the second brood, conditions are difficult and the adults, especially the females, may lose weight. Dr. Bryant has shown that those females rearing two clutches a season have slightly poorer lifetime success than those attempting only one brood per season but surviving to breed more often.

For a small songbird, therefore, reproductive success is a tricky business, the balance between knowing when to save one's own life and when to risk it on behalf of the young. The cautious bird may live long but leaves few descendants, while a bird that produces too many eggs or defends them too closely does not live to see them fledge. Yet the facts speak for themselves: most birds do produce just that number of young that human biologists and their computers judge mathematically as being most productive—truly a remarkable testament to the power of natural selection.

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Dr. Raymond J. O'Connor is director of the British Trust for Ornithology.

Teleonomically Speaking

We speak of birds having "strategies" as if they consciously determined their own behavior. Of course, birds do not plan to "maximize their reproductive output" but we have fallen into the habit of referring to them as if they do. This habit is really a kind of shorthand that biologists and ornithologists use, and it is so pervasive that it even has a name. It is called teleonomy.

Teleonomy makes evolution seem as if it were ruled by an overall purpose or design, as if the animals themselves had some say in its direction. Actually birds and all other species have evolved as a result of the action of many natural forces, such as weather, predation, and disease. So when we speak of a songbird having reproductive strategies we mean: what assemblage of characteristics have been observed, which ones have been shaped over many generations by the process of natural selection, and have allowed this bird to survive? What is it about its shape, size, color, behavior, or distribution that has contributed to its ability to survive, reproduce, and pass on its genes? Why has this individual survived to reproduce, while that one has perished? How have species responded and adapted to their environments over the millennia? We do not mean to imply that foresight and reasoning were called for on the part of the individual bird.

In his book, *This View of Life—The World of an Evolutionist,* George Gaylord Simpson relates that biologists speak teleonomically when they are trying to answer the how and why of the events they observe, and these are some of the most intriguing questions in nature.

The Fledging of ICF: 10 Years of Progress

by Alice D'Alessio

There is irony in the struggle for survival of the crane. Throughout history it has been revered in many cultures as the symbol of long life and good fortune. Today, of the 15 species of cranes, seven are severely endangered. After 60 million years on this earth, the cranes' own good fortune seems at an end. However, despite the plundering of their numbers in their native India, and the disappearance of their habitat in China and elsewhere, the crane population flourishes in the unlikely setting of Baraboo, Wisconsin.

In 1972, while George Archibald was completing his Ph.D. on crane behavior at the Laboratory of Ornithology at Cornell, he met Ron Sauey, who was beginning his graduate research on the Siberian crane, *Grus leucogeranus*. Their concern over the plight of the great birds spurred them to establish a special foundation dedicated to the preservation of cranes. They selected Baraboo as the home of the new conservation center, the International Crane Foundation.

In the beginning there was little more on the converted horse farm than a lonely pair of sandhill cranes, *Grus canadensis*, and plenty of dedication. But through field research and discussions with other experts, George and Ron learned what had to be done. The ICF program would include five areas: (1) research, both in the field and at the foundation; (2) habitat conservation; (3) breeding of captive cranes; (4) restocking, after preservation of an area is assured; and (5) public education.

Since some species, such as the Siberian crane and the red-crowned crane, *Grus japonensis*, had already declined to a critical level, captive propagation was a first priority of the young foundation. A "species bank" of endangered cranes would guard against extinction. George and Ron contacted zoos and wildlife centers all over the world requesting birds on special breeding loan agreements.

And the birds started to arrive—from the Brookfield Zoo in Chicago, Busch Gardens in Tampa, from the Honolulu Zoo, from San Antonio, and Tokyo's Ueno Zoo, from Milwaukee Zoo, and the Patuxent Wildlife Research Center in Maryland. The inventory grew. Six European or common cranes, *Grus grus*, arrived as eggs from Sweden. Six brolgas, *Grus rubicunda*, came from Australia after George received permission from the Australian government to capture the elusive creatures in the "outback." By 1977, 14 of the 15 species were represented at ICF. Only the black-necked crane, *Grus nigricollis*, was missing.

Summer of 1975 was a milestone for the young organization. In July, a pair of bedraggled chicks pulled free of their shells and became the first cranes laid, incubated and hatched at ICF. "Tancho" and "Tsuru" were also the first red-crowned cranes ever hatched in the United States. No more than 300 were known to exist in the wild. The following summer five more of this species hatched, as well as offspring from four other species.

With the breeding program off to a good start, George and Ron headed for countries where the birds were most endangered to continue their research and diplomacy. George flew to Korea, where 1,000 white-naped cranes, *Grus vipio*, and several red-crowned cranes had been counted in the Han River Estuary at the western edge of the Demilitarized Zone (DMZ). George proposed to the South Korean government that the vast marsh be made into a bird preserve. His appeal was successful and today this area teems with wild waterfowl.

In the interior of the mine-studded DMZ, George counted more than 30 red-crowned cranes, and suggested that the North and South Koreans cooperate in feeding the beautiful birds.

"Since these birds symbolize good fortune to North and South Koreans alike, they seemed to be perfect subjects for cooperation," said George. Amazingly, the two hostile camps agreed, and a DMZ crane feeding station was established.

Brownie and Lindsay are the first Australian brolgas produced in North America

George also made aerial surveys in northern Japan, where he discovered a population of red-crowned cranes nesting in the Hokkaido marshes. The birds had previously been thought to migrate to mainland China for breeding. Since the marshes were about to be drained and developed, the situation was critical. George gathered local support and established a Japanese branch of ICF, with the goal of enlisting businesses to sponsor wetland acreage for the cranes. This campaign, still being fought with agonizingly slow progress, highlights the ultimate question: can humans and cranes live side by side?

While George fought for the cranes in East Asia, Ron was completing his thesis research on Siberian cranes. He visited their wintering grounds in India and Iran, huddling in marshes before dawn to observe feeding habitat and to trace migration routes. He also made a point of establishing contacts with local scientists and wildlife lovers, and, as a result, an ICF public education campaign gained the personal support of Prime Minister Indira Ghandi. Shortly thereafter, the Bharatpur Bird Sanctuary in central India, where the Siberians winter, was designated a national park, promising increased protection for the big birds.

Threats to the Siberian crane continued to be a major concern of George and Ron, and led to an ingenious U.S./Soviet project. Alarmed over the decreasing number of the rare white bird, Soviet scientists agreed to provide eggs to ICF as the nucleus of a captive breeding program, and thus "The Great Egg Heists" were begun.

Vladimir Flint, of the USSR Ministry of Agriculture's Central Laboratory for Nature Conservation, gathered eggs on the Siberian tundra in 1977 and 1978 and delivered them to ICF representatives in Moscow in elaborate and carefully timed operations. The 1977 egg lift went flawlessly, and from the four Soviet eggs two healthy chicks were raised.

The 1978 egg lift had a few nerve-wracking moments. In Moscow, Ron was handed a suitcase containing seven eggs, and was hustled aboard a plane for the remainder of the 10,000 mile journey. Somewhere over the Atlantic the suitcase started cheeping, and for 13 sleepless hours Ron juggled the eggs in the suitcase to keep them uniformly warm and to monitor the over-eager chick. When the little one emerged over Cleveland, he promptly named it "Aeroflot," for the Soviet airline that had brought it halfway around the world. From the other six eggs, three more chicks survived to join the growing Siberian enclave.

Eggs from these Siberian cranes may be part of a reintroduction program similar to the whooping crane "foster parent" program in this country. The goal is to place Siberian crane eggs in nests of common cranes, and thus to re-establish flocks in safer habitat. Meanwhile, ICF has helped the Soviet scientists start their own captive breeding program on the Oka State Nature Reserve southeast of Moscow. Grateful Soviet scientists named their first chicks "George" and "Sauey."

Back in Baraboo, innovation and experimentation have led to major breakthroughs in the breeding program. Artificial insemination proved the most reliable means of gaining fertile eggs. But stimulating the birds to lay required creativity. Phillis, a female Siberian, danced and called in typical crane fashion with Wolfe, an elderly male from the Vogelpark Walsrode in Germany. But in 24 years at the Philadelphia Zoo, Phillis had never laid an egg. Perhaps the missing stimulus was the long daylight Siberians experience during their breeding season in the arctic. As an experiment, floodlights were installed to provide the extra period of light, and Phillis responded with a total of 12 eggs! Although no eggs were fertile, it was an important step.

The brolgas presented a different challenge. In Australia they breed dur-

Above: *Even though not in its native habitat, this red-crowned crane juvenile has adapted to life in Baraboo*

Left: *George Archibald, left, Aeroflot, center, and Ron Sauey, arrive on U.S. soil*

The protection this red-crowned crane receives at ICF helps to insure future generations

Photographs thanks to ICF

ing the monsoon season. A Wisconsin monsoon seemed improbable, but a sprinkler system substitute encouraged the brolgas, and in spring of 1979 they produced the first of their species hatched in the United States.

By 1981, more than 125 cranes of 14 species preened, strutted, and performed their elaborate rituals on the rolling Wisconsin hillsides. The 25 new babies hatched last year cheeped and wobbled on the lawns under the watchful eyes of human volunteers dubbed "chick mamas." The biggest news was the birth of Dushenka, the first Siberian crane ever bred and hatched in captivity.

In January of 1982 George Archibald visited China to assist the government in mapping a conservation strategy for the seven crane species that inhabit or migrate through China. It was a long-awaited visit, the culmination of years of delicate negotiations. In addition to the opportunity to survey crane wetlands and influence habitat conservation, George hopes to obtain eggs or adults of the one crane not represented at ICF, the rare black-necked crane. Reports from its remote Tibetan homeland suggest that its numbers have been severely depleted and captive breeding may be its last hope.

The story is far from over. Restocking programs are still in their infancy. Human population pressures continue to threaten crane habitats around the world, and the ultimate question of co-habitation with humans has not been answered. However, the ICF can look back on a decade of remarkable success, and through its continued efforts, long life and good fortune may once again smile on the cranes.

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THE RETURN OF THE ATLANTIC PUFFIN

to Eastern Egg Rock, Maine

by Stephen W. Kress

1887: Deep under a huge boulder, an Atlantic puffin, Fratercula arctica, *wedged itself into a shadowed corner to incubate its single egg. For 10 years it had returned to this hidden crevice on a wind-blasted jumble of granite called Eastern Egg Rock, eight miles to sea off the Maine coast. But even here there was little safety. Above, muffled voices reviewed plans to spread herring nets over the boulders to trap puffins as they emerged in the early dawn.*

Puffins and other seabirds had been hunted on this tiny island for several hundred years. But by 1887, seabirds were scarce. Only a few terns flushed from the trampling feet of grazing sheep and virtually no puffins teased fishermen by circling within gunning range. Trapping efforts were poorly rewarded; only one puffin struggled in the waiting net.

Little did the disappointed fishermen realize that there were no more puffins on Eastern Egg Rock,

Atlantic puffin, Handa Island, Scotland. Photograph © by J. C. Carton (Bruce Coleman Inc.)

or on nearby Western Egg Rock, and that most seabird populations from Florida to Labrador were in a state of serious decline. By 1900, puffins had been eliminated from all but two colonies in the Gulf of Maine: Machias Seal Island and Matinicus Rock. Where once they had been abundant, puffins and most other seabirds had almost disappeared from the islands of Maine.

However, by 1900, things began to change. With protective legislation, such as the federal Migratory Bird Treaty Act of 1918, The Lacey Act and Maine's Model Wild Bird Act (both of 1900), puffins received a legal reprieve from more than 200 years of excessive hunting. Even more important to the renaissance of seabirds were the life style changes affecting coastal Mainers around the turn of the century. Long isolated by the convoluted coastline, highways and railroads were starting to connect even remote communities. With the advent of electricity and refrigeration, fresh seafowl meat and eggs became less important. Gasoline-powered boats made it possible for fishermen to commute to and from the mainland. This combination of life style changes and protective legislation made the islands suitable for nesting once again.

Arctic and common terns, *Sterna paradisae* and *S. hirundo*, were among the first birds to re-colonize islands such as Eastern Egg Rock. And their return was noteworthy. They had not inhabited Egg Rock since the millinery raids of the 1880s destroyed their populations. But puffins, unlike terns, are not quick to settle into new nesting sites nor are they known for their ability to arrive *en masse* to a suitable habitat. If puffins were to re-colonize Egg Rock in the near future, we would have to devise a plan to help them along.

Our effort to re-establish a breeding colony of puffins at Eastern Egg Rock began in 1973 with financial support from the National Audubon Society and private contributors. Dr. Robert Noyce, a good friend and neighbor of the Audubon Ecology Camp in Maine, flew us to Newfoundland in his private plane to collect puffin chicks during the first three years of the project. These chicks and those from subsequent transplants were reared on Egg Rock by biology students from Cornell and other universities.

Our re-establishment program was based on the premise that young puffins usually return to breed at their natal island, sometimes in the immediate vicinity of their parents' burrow. All we had to do was to transplant some young puffins to Egg Rock and hope that eventually they would return there to breed. As simple as this sounds, we had no way of knowing if it would work. However, the vision of bright-beaked adults coursing over the boulders was incentive enough for us to try.

"Can't be serious," grumbled a crusty old lobsterman when I explained my plan to have assistants live in a tent on Eastern Egg Rock. Surely if the winds didn't shred the tent, the rigors of rain, sun and flood tides would prevent us from surviving on this seven acres of salt-sprayed, treeless granite. Yet our resolve, the novelty of the adventure and a good dose of blind optimism made the goal of re-establishing puffins on Eastern Egg Rock seem highly plausible and worth whatever physical discomforts the island had in store.

It was August, 1973 when we arrived at Egg Rock with some very unusual cargo. As the greater black-backed gulls, *Larus marinus*, chanted overhead, five fledgling puffins huddled against the walls of the artificial burrows we had constructed for them. These two-week-old chicks were from the large puffin colony on Great Island, Newfoundland, and were hand reared on nearby Hog Island. We reasoned that by this age, young puffins are capable of maintaining their own body temperature and should be strong enough to resist the shock of the transplant. We gambled that they probably had not learned where home was and that if we transferred them quickly to a new island, finish rearing them there and then permit them to fledge, they should acquire their homing information at the release site and return there to breed several years later.

Little is known about how seabirds find their way home after winter migrations that may take them thousands of miles away, but the transplant program rested on the hypothesis that while the puffin's methods for homing were of a genetic nature, the specific information was learned some time during the development of the nestling. Although resident gamebirds such as turkey and pheasant have been successfully transplanted for years to stock vacant habitat, this was the first time such a program had been ventured for a migratory seabird.

While waiting for our transplanted puffins to mature on Egg Rock, we prepared the island for them by establish-

Stephen Kress places nestlings in carrying case for the 1,000 mile journey from Great Island, Newfoundland to Eastern Egg Rock

Both male and female puffins bring food to their single nestling

Stephen Kress

ing ten colonies to control the gull population, and by securing the island's status as Audubon's Allan D. Cruickshank Wildlife Sanctuary.

Besides gaining safety for the puffins, we studied the development of our nestlings, examining the sequence in which new feathers and behaviors transformed the helpless and clumsy chick into a trim and alert young seabird. To learn as much as possible about these changes, we built an observation blind over four plexiglas-roofed burrows and noted the behavior of four nestlings from 1976 to 1978. These puffin chicks showed remarkable variety in personality. Some were vocal, restless birds that actively roamed their underground domain, excavating side chambers of their own design, pursuing intruding flies and mosquitoes and sometimes arranging platforms of vegetation on which they rested in their nest chamber. By contrast, other chicks seldom moved from their nest chamber except to consume their daily rations.

Our studies of nestling behavior revealed some of the ways that puffin chicks avoid the menacing gulls which frequently wait outside their burrows. By monitoring the puffin chicks in our observation burrows, it soon became evident that even the most active avoid the vicinity of the burrow entrance until they are about four weeks old. During these weeks the slow, awkward chicks would be easy prey if they ventured too close to the entrance. We observed that deep inside the burrow the young chicks have a well-defined toilet area just outside their nest chamber. Here they back to the toilet wall, bend forward and squirt their excrement against it. By concentrating the excrement in one location the chick stays clean and avoids danger at the burrow entrance.

After four weeks, the chicks usually move their toilet closer to the burrow entrance. Even though they are now much quicker and more coordinated, they still show the greatest caution. The usual approach is to edge slowly toward the entrance with the head held low. If all is clear, the nestling makes a quick 180 degree turn, backs up a few steps and ejects a vigorous stream that may be propelled more than a foot outside the burrow. Then, without hesitation, the chick dashes back to the dark safety of its nest chamber.

As fledging time approached, the nestling puffins became increasingly active, pacing the length of the burrow, frequently rejecting food in the day or two prior to fledging. At night, when gulls sleep, the young puffins left their burrows to clamber over intervening boulders and crevices until they reached the sea. I have hidden among the boulders to watch the procession, listening for the clinking sound of metal bands against the granite. If moonlight permitted, a small white apparition appeared, for only the fledgling's white breast was visible, the dark head and body feathers blending into night shadows.

Balancing with wing and sharp claws, the fledgling may climb up the boulders, only to tumble into a crevice and struggle forward again. Once I saw a bird gain the peak of a tall boulder and fly off to sea in a single attempt, but most plunge into the foaming surf, sometimes to be thrown back repeatedly to the island. When clear of the surf, the young birds dive and bathe as if they have done this many times before. By dawn the fledglings are no longer in sight from the island and no longer vulnerable to the predatory gulls which patrol the inshore waters.

By June of 1977 we had released 248 young puffins from Egg Rock without having a single return. We were concerned that if the puffins did return, they would hesitate to come ashore without seeing established adults to attract and hold their interest. To overcome this problem, we prepared standing decoys and secured them atop several granite outcrops. We also moored floating decoys to the ocean bottom near the island, but strong seas soon broke them free, scattering them southward in the Gulf of Maine current.

Even though we had watched daily during the summers of 1974 through 1976, we had sighted only one adult puffin at Egg Rock, that being a solitary bird that circled the island once in 1974. It was therefore a momentous occasion on June 12, 1977 when a puffin rounded the shore of Egg Rock and splashed down just as we were rowing ashore. With absolute confidence, the bird swam up to our landing boat where we could easily see that it carried a white band on its left leg—proof at last that at least one transplanted chick from Newfoundland had found its way back to Egg Rock.

Our studies of two and three year olds show that puffins freely move among the Gulf of Maine colonies, but when they are three and four years old, they become involved in burrow prospecting and do less inter-island traveling. In 1979, at Matinicus Rock, 26 miles from Eastern Egg Rock, we observed a four-year-old transplanted puffin that seemed especially fixed to a particular boulder site. This bird, identified as white #14 by its metal band and white plastic leg band, was one of 91 nestlings transplanted to Egg Rock from Great Island in 1975. Now at Matinicus Rock, it was defending a territory, growling and chasing other puffins that ventured too close. In 1980, white #14 was observed carrying fish into the same rock crevice for its own young. This was an exciting discovery for not only was it proof that transplanted puffins will breed near the release site, but it also demonstrated that puffins will select their nesting colony and defend a burrow site the year before they actually nest, thus shedding some light on at least one reason for delayed breeding.

It was late May, 1981 when we landed at Egg Rock and already the puffins were coming and going among the boulders. We had observed this behavior for the past two summers, but most of the puffins were four and five years old now and the chances for breeding had never looked better.

Decoys are used to attract puffins to Eastern Egg Rock

M. Hopiak

Through late May, June and July the puffins teased us with their secretive habits. At Matinicus Rock, puffin chicks hatched as early as June 7, but these were older, more experienced breeders that lay their eggs soon after arrival in mid–April. Yet as July began to unfold, we reasoned that if puffins were breeding at Egg Rock, their eggs must hatch soon because it would take the adults at least another six weeks to rear the chicks—a process that must be complete before the migratory urge pulls the adults back to the open sea by mid–August.

It was nearly dark on a very hazy fourth of July when I spotted a puffin winging around the south end of Egg Rock, its beak packed with glistening herring. Without hesitation, it landed and scrambled into the boulders to emerge a moment later without a trace of its catch. After nearly 100 years of absence, puffins were nesting again at Egg Rock.

Five pairs of puffins hatched young at Egg Rock in 1981 and, as far as we know, all successfully fledged their young. Both members of three pairs were four-year-old birds, one pair consisted of a four year old and a five year old, and surprisingly, both members of the remaining pair were unbanded. Since there has been relatively little band loss, it is likely that these unbanded birds are recruits from either Matinicus Rock or Machias Seal Island. A certain amount of inter-colony breeding is normal even under completely natural conditions and these welcome additions may play a vital role in expanding the new Egg Rock colony, offsetting the loss of transplanted birds to other colonies.

Once puffins select a nest site and successfully breed, they usually return to the same island and burrow for many years. Thus the future of the new Egg Rock colony looks encouraging since this core of breeders will help attract increasing puffin numbers to the island. Of the 530 transplanted puffins old enough to have returned by 1981, 111 or 21 percent have been sighted at Egg Rock, Matinicus Rock, or Machias Seal Island. In the next year or two numbers will further increase as the 1980 and 1981 transplant groups reach breeding age and return.

While the future of the Egg Rock puffin project looks bright and the techniques developed could have application for other colonial seabirds, restoration projects must be only part of a comprehensive management program. Puffins are declining throughout their extensive range on both sides of the North Atlantic. Tragic losses result from poaching, drowning in fishing nets, and predation from increasing herring and greater black-backed gull populations. Although puffins still nest in a few colonies of more than a hundred thousand pairs, the losses from oil spills and overfishing of their food supplies can be enormous.

Puffins have survived hundreds of years of human history on the Maine coast, but it has taken all the tools of conservation to restore them from the grim days of seabird exploitation. Legislation, enforcement, sanctuaries, and active management are necessary if the puffin is to maintain its precarious posture on the Maine coast. Certainly the ability to re-establish puffins to former breeding sites is a useful new management tool, but to secure the puffins' future, we need a worldwide commitment to work toward maintaining the highest possible productivity and diversity of the seas.

FURTHER READING

Friedman, J. *Puffins, Come Back.* Dodd, Mead & Co., New York. 1981.

Lockley, R. M. *Puffins.* Devin-Adair Co., New York. 1953.

THE AUTHOR

Dr. Stephen W. Kress is a staff biologist and lecturer for the National Audubon Society and director of the Audubon Ecology Camp in Maine. He is also a laboratory associate of the Cornell Laboratory of Ornithology.

The Plovers, Sandpipers, and Snipes of the World
Eliot Porter
Birds of North America
A Personal Selection
THE AGE OF BIRDS
ALAN FEDUCCIA
The Oxford Companion to Animal Behavior
FINDING BIRDS AROUND THE WORLD
PETER ALDEN/JOHN GOODERS
Birds of the West Indies
by James Bond
A FIELD GUIDE TO AUSTRALIAN BIRDS
NON-PASSERINES
PETER SLATER

D. Blanton

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by Eliot Porter

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by J. G. Williams and N. Arlott. The plumage, size, voice, flight, habitat and distribution of over 650 species are described and illustrated.

415 pages, cloth, 1963. $14.75/12.54 members.

Freshwater Marshes—Ecology and Wildlife Management

by Milton W. Weller. The fragile components of a marsh are discussed, describing plant and animal communities and their interactions.

146 pages, paper, 1981. $8.95/7.61 members.

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by James Bond. More than 400 species are portrayed in color and black-and-white plates with descriptions covering diagnostic features, habitat, range, eggs and nests.

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by Peter Slater. Bird size, range, habitat, voice, and plumage are described in detail, covering every Australian passerine and non-passerine. Color and black-and-white plates.

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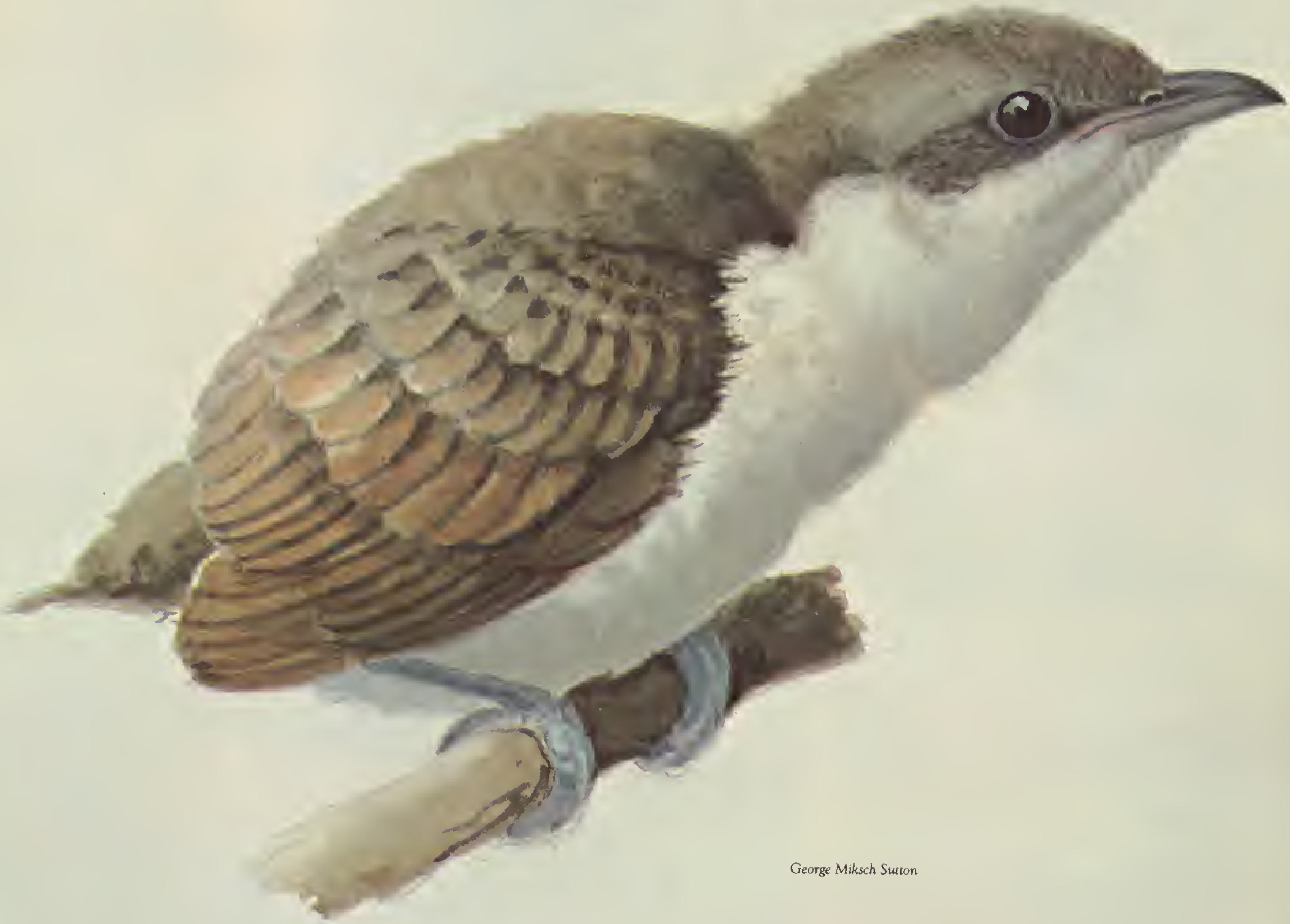


George Miksch Sutton

Cuckoo drawn from life
Arboretum, Ann Arbor
June 24, 1948
Nate Potter III

. . . Then had come the day when, miracle of miracles, the blood-quills had broken open at the tips and lo, the little reptiles were birds after all . . .

Portrait of a Young Cuckoo

by George Miksch Sutton

On June 24, 1948, Nate Potter III found a well feathered though not fully fledged young cuckoo in the arboretum at Ann Arbor, Michigan. He had heard me say to his friend Josselyn Van Tyne that I wanted to draw birds directly from life, so he brought the little thing to me as promptly as possible. He explained that it had tried to avoid capture not by flying but by climbing slowly from twig to twig through the shrubbery not far from the ground; that he had caught it without trouble; that he had found no nest of any sort close by; and that no adult cuckoo had scolded him, or even shown up, while he was handling the young bird.

The only cuckoos any of us had seen in the arboretum that summer were yellow-billed cuckoos, *Coccyzus americanus,* so we jumped to the logical conclusion that the baby was of that species. There was not a word of argument about the matter. I was especially interested in the fact that there was no hint of yellow in the bill or of red in the skin surrounding the eyes. What I wanted was an authentic record of the colors of those fleshy parts.

The winsome creature was perfect as a model. It made not the slightest attempt to fly, nor did it beg for food. It did lift its stub of tail occasionally, as if excited by some sound. As I worked I could not help thinking of the many cuckoo nests I had found in other parts of the yellow-bill's wide breeding range. Especially did I remember those that I had visited day after day in an attempt to pin down facts about the period of incubation, the behavior of parent birds, and the appearance of newly hatched chicks. The hatchlings had been weird creatures—dark-skinned, scrawny, covered not with down but with grayish white "hairs" that looked as if they had been smeared on.

At one exceptionally low nest that my class at the University of Pittsburgh and I had found within walking distance of the campus, the parent bird had amazed us by continuing to brood the small chicks until I had almost touched it. Then, instead of flopping to the ground, feigning injury, it had slipped from the nest with wings spread wide and descended gently, coming to rest on some leafy twigs where it stayed as if sure that I would try to catch it.

We had watched the young ones at that nest develop. The "hairs" had presently been pushed from the skin by the incoming blood-quills and many had broken off. The quills had been so neatly lined up in tracts that I could lecture to my heart's content on pterylosis and feather-growth. Then had come the day when, miracle of miracles, the blood-quills had broken open at the tips and lo, the little reptiles were birds after all! The baby cuckoo before me was feather-covered all right, but many of its feathers were still sheathed at the base.

This is not the end of my story. For over 30 years, I have told everyone that my sketch was of a yellow-billed cuckoo. But I have wondered, and quite sincerely, whether my model could have been a black-billed cuckoo, *C. erythropthalmus.* To be sure, no one had reported seeing black-bills at the arboretum early in the summer of 1948. Identification of my model as a yellow-bill was sound enough. But I had observed the black-bill repeatedly at the Edwin S. George Wildlife Reserve, not far from Ann Arbor. Indeed I had found several black-bill nests there. The two cuckoo species had long been known to lay their eggs in each others' nests (a curious, somewhat pointless form of social parasitism), so my model could have been a black-bill hatched and reared in a yellow-bill's nest [see Forbush, 1927, *Birds of Massachusetts and Other New England States,* Norwood Press, Vol. 2, pp. 243, 246; Bent, 1940, *U.S. Natl. Mus. Bull.* No. 176, pp. 56, 72; Todd, 1940, *Birds of Western Pennsylvania,* Univ. Pittsburgh Press, pp. 275–6]. I was truly bothered by the fact that my model's bill had been so dark. It had not had a trace of yellow in it.

The bird I drew was indeed a young yellow-bill. The underparts of a young black-bill of the same age would have been grayish white with a buffy tinge on the chin and throat, and the dark plumage of the upper parts might have been edged with pale grayish buff, producing the effect of faint scalation. But I continue to wonder when the yellow begins to show on a young yellow-bill's bill and whether the featherless area around the eye of a young black-bill ever shows a trace of red. In a young male black-bill specimen (Carnegie Museum No. 137643) found dead in Butler County, western Pennsylvania on September 25, 1957, and prepared as a skin by Kenneth C. Parkes, the "circumorbital ring" was "bright yellow." The change to red probably takes place on that species' wintering ground.

THE AUTHOR

George Miksch Sutton is an artist, author, and lecturer as well as George Lynn Cross research professor of Zoology Emeritus and Curator of Birds at the Stovall Museum of Science and History at the University of Oklahoma.

RESEARCH & REVIEW

by Richard E. Bonney, Jr.

Birch, Beech, Maple?

Consider an insect-eating bird feeding among forest trees. To a bird watcher, the trees all look pretty much the same. But how do they look to the birds? Does the bird use certain species of trees more than others? Or does it forage randomly through the forest?

These questions are the most recent to gain attention in the ongoing bird studies at the Hubbard Brook Experimental Forest in New Hampshire's rugged White Mountains. Under the direction of Dr. Richard Holmes, avian ecologists at Hubbard Brook have been studying bird foraging techniques and patterns since 1974. Holmes and his colleagues have published several papers that give insight into the ways in which vegetation affects the distribution and abundance of forest birds. The most recent paper, "Tree species preferences of foraging insectivorous birds in a northern hardwoods forest" (Holmes, R. T. and S. K. Robinson, *Oecologia,* vol. 48, pp. 31–35) contains some surprising results.

Holmes and Robinson analyzed several thousand foraging observations collected over a three-year period, and found that birds feeding in the Hubbard Brook Forest do indeed have distinct preferences for and/or aversions to certain tree species. The study site is dominated by American beech, *Fagus grandifolia,* yellow birch, *Betula allegheniensis,* and sugar maple, *Acer saccharum,* with scattered white ash, *Fraxinus americana,* and conifers. Of the 10 foliage foragers, that is, birds that feed primarily in the leaves of the forest canopy, yellow birch is favored by all species. Beech is almost entirely avoided, except by scarlet tanagers, *Piranga olivacea;* sugar maple is generally avoided except by red-eyed vireos, *Vireo olivaceus,* and American redstarts, *Setophaga ruticilla.* Conifers, rare and patchily distributed, are used only by solitary vireos, *Vireo solitarius,* and blackburnian and black-throated green warblers, *Dendroica fusca* and *Dendroica virens,* while ash is used rarely except by the high-canopy foraging Philadelphia vireo, *Vireo philadelphicus.*

Perhaps, if you have spent much time carefully observing birds, these results do not seem too surprising. You may well have noticed that some birds are more commonly observed in certain types of trees. It is surprising, however, to many avian ecologists.

The primary reason for this surprise can be traced to a classic paper published by Robert and John MacArthur in 1961. They proposed, on the basis of investigations in eastern deciduous forests, that the diversity of forest bird communities could be predicted by measuring the amount of foliage at different heights in the forest—regardless of the plant species present. They added that knowledge of the number of plant species in the forest did not improve their ability to predict the number of bird species. Since that time, dozens of papers have been published either supporting or disputing MacArthur's correlation. But differential use of tree species has generally been ignored as an important influence on distribution and abundance of birds.

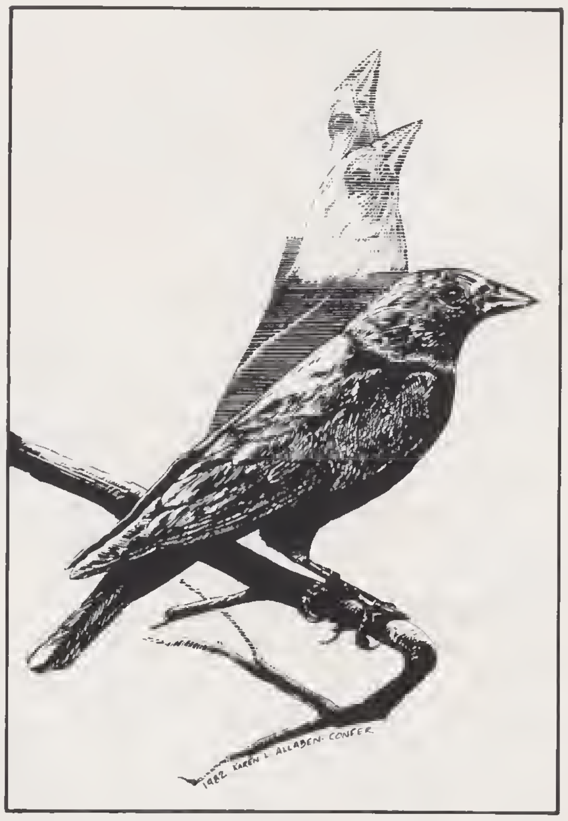
Why do insectivorous birds prefer or avoid certain tree species? Holmes and Robinson offer two explanations. The first concerns prey abundance; the second, the ease with which birds can forage in the different kinds of trees.

Numbers and types of insects found on leaves of the different tree species are known from a related study. The types of prey found on each species are similar. However, yellow birch, the tree favored by all 10 bird species, supports the highest prey density throughout the breeding season. It is logical, then, that the birds would concentrate their feeding efforts on birch.

But the researchers don't feel that differing prey abundances are sufficient to account for the extreme preferences or aversions of some bird species. They suggest that, additionally, some birds may have an easier time foraging in yellow birch because of the structure and arrangement of its twigs and leaves. Yellow birch leaves are close together, have short stems which place them close to their supporting twig, and are arranged so that a bird can see the surfaces of many leaves at once. In contrast, maple and beech leaves are less visible and less accessible from the twig to which they are attached. Consequently, for birds that feed by picking stationary insects from leaves while standing on a branch or twig (gleaners), less energy would be expended foraging in birch than in beech or maple.

The foraging techniques used by different species of birds feeding in different kinds of trees at Hubbard Brook support this idea. Gleaners do have the strongest preference for yellow birch. In contrast, those species that show lesser preferences are the hoverers—birds that pick stationary prey from leaves while hovering or flying. These birds are probably less constrained by foliage structure.

One further finding bears noting: the abundant bird species in the Hubbard Brook Forest are the least particular about the trees from which they feed, while those with the strongest preferences are least common. Holmes



Head raising and strutting are typical aggressive postures of cowbirds defending their territory and Robinson feel that the distribution and abundance of rarer bird species may be linked to the presence and distribution of particular species of trees. For example, on the study site, blackburnian warblers occur only where there is at least one large conifer.

What are the implications of these findings? For one, the study shows the potential importance of tree species—even species that look similar—in determining the structure of bird communities. Certainly differential use of tree species should be considered in future studies.

But perhaps more importantly, these findings have a direct bearing on forest management. For anyone concerned about wildlife conservation—whether as the manager of a large national forest or the owner of a small backyard woodlot — it is necessary to recognize that tree species diversity almost certainly affects the distribution and abundance of forest birds. Imagine the effect of a heavy selective logging of yellow birch at Hubbard Brook, for example. This tree is of high veneer quality and is of value to the lumber industry, but its removal could result in a lowering of the number of most songbirds in the forest. Or consider the removal of the conifers; blackburnian warblers could disappear. Clearly, we must see through the forest to the trees.

Accept, Bury, Desert

What can a bird do when a brown-headed cowbird, *Molothrus ater,* lays an egg in its nest? It can accept the egg; bury it, along with its own, by building a new nest floor; eject it from the nest, or desert the nest. In an effort to understand these responses, Karen Clark and Raleigh Robertson of Queen's College, Ontario, examined 45 naturally parasitized yellow warbler, *Dendroica petechia,* nests (*Wilson Bulletin,* vol. 93, pp. 249–258).

The warblers accepted the egg at only 28 percent of the nests; those nests usually had two or more warbler eggs when the cowbird egg was laid. Fledging success was considerably lower than at unparasitized nests. Cowbird eggs were rejected at 72 percent of the nests: 48 percent by burial and 24 percent by nest desertion. These nests generally had one or no warbler eggs when parasitized. Fledging success at nests with buried cowbird eggs was nearly equal to that of unparasitized nests. No birds ejected eggs.

The response to parasitism, then, varies with the amount of time and energy already invested in young. Burial, resulting in high fledging success, occurs earlier in the season when few eggs have been laid; acceptance occurs later, when there is insufficient time to lay a new clutch.

Saving Energy

Weight loss, commonly observed among nesting female songbirds, has been thought to result from physiological stress placed on them as they struggle to meet the food needs of their hungry offspring. Another explanation, however, has been suggested by Leonard Freed of the University of Iowa (*Ecology,* vol. 62, pp. 1179–1186).

Freed weighed more than 100 male and female marked house wrens, *Troglodytes aedon,* at various stages of their breeding cycles. He found that females lost 13 percent of their total body weight during the period from incubation through fledging of their young. However, half of the weight loss occurred before hatching was completed, and nearly all loss was achieved before food demands by the nestlings became greatest. Also, females with larger broods did not lose more weight than females with small broods.

Freed concluded that weight loss is not caused by stress. Instead, because males and females have similar weights at the end of the nesting period, he feels that female weight loss results from degeneration of reproductive tissue. Since lowered body weight reduces the power required for flight, Freed points out that it is probably important for females to lose bodily substance necessary only for egg formation and incubation when it comes time to supply their young with food. Weight loss, then, may actually be an energy-saving adaptation.

THE AUTHOR

Richard Bonney is an environmental and natural history writer and photographer from Pittsfield, Mass.

NEWS & NOTES

Noted Canadian sound recordist William W. H. Gunn will be the recipient of the 14th **Arthur A. Allen Award.** Roger Tory Peterson will present the medal at the banquet on October 2 of this year.

A Gift of Rare Wines from Laboratory member Norman Kraft grossed $20,000 in an auction held in Chicago recently. The money will help establish the Cornell Wild Bird Research and Rehabilitation Fund, joint project of the Laboratory and the New York State College of Veterinary Medicine at Cornell.

The Home Study Course in Bird Photography is now available. A new incentive for students will be a photography competition. Winning photos will be published in *The Living Bird Quarterly.* Contact D. Blanton, ℅ the Laboratory of Ornithology.

The 19th Edition of *The Living Bird* will be sent to you within the next few months.

Find a **Sick or Injured Bird** in the Ithaca area? Call the Laboratory. We'll make arrangements to treat the bird at the Avian Clinic at the N. Y. S. College of Veterinary Medicine. Doctors and students have returned many recovered birds to the wild.

New Record Release! Bird Songs of the Dominican Republic, recorded by George B. Reynard; features 100 species including all species endemic to Hispanola. $11 post paid, $9.50 members (N.Y.S. residents add 7% sales tax). Available at *The Crow's Nest Bookshop,* ℅ the Laboratory of Ornithology.

The Laboratory's **Photographic Department** needs high-quality slides of birds for its collection. In particular: scoters, hawks, alcids, flycatchers, thrushes, vireos, warblers, and sparrows. Please send donated slides to Photo Dept., ℅ Laboratory of Ornithology.

EXTINCTION. IT'S FOREVER.

One quarter of all species of animals and plants on Earth may disappear in the next 30 years because of man's destruction of their habitat. The rate of extinctions is increasing enormously as forests are destroyed and other wild areas are lost. Organisms that evolved over hundreds of millions of years will be gone forever. The complex interdependence of all creatures, from the largest mammals to the smallest plants, is being shattered. It is a crisis with profound implications for the survival of all life. Unfortunately, little is being done to save our planet's natural heritage. Here are some warnings by leading scientists:

"The worst thing that can happen—will happen—in the 1980's is not energy depletion, economic collapse, limited nuclear war, or conquest by a totalitarian government. As terrible as these catastrophes would be for us, they can be repaired within a few generations. The one process ongoing in the 1980's that will take millions of years to correct is the loss of genetic and species diversity by the destruction of natural habitats. This is the folly our descendants are least likely to forgive us."

DR. EDWARD O. WILSON

Baird Professor of Science • Harvard University

"Few problems are less recognized but more important than the accelerating disappearance of Earth's biological resources. In pushing other species to extinction, humanity is busily sawing off the limb on which it is perched."

DR. PAUL EHRLICH

Bing Professor of Population Studies • Stanford University

"We are encroaching on nature, in the U.S. and around the world, at an unprecedented rate. A large proportion of the chemicals in use in our present-day civilization were 'invented' by nature, not by the chemist in the laboratory. An estimated 40% of all drug prescriptions in the U.S. contain as their chief ingredients compounds derived from plants. There is no end to the potential for discovery in nature, because we have only begun the chemical exploration of nature. Tragically, we are burning our library of priceless genetic treasures with our reckless destruction of species."

DR. THOMAS EISNER

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AN AMIABLE GIANT: FUERTES'S GORILLA

By Dian Fossey

"The gorilla is a savage: enormous, hirsute, aggressive, cunning, a predatory beast of violent passions." So suggested an explorer of Africa Paul Belloni Du Chaillu a century ago in front of audiences in London. Without airplanes, movies and television, few had seen the great ape and therefore could not know Du Chaillu's description was fanciful. Thus the myth was taken as fact.

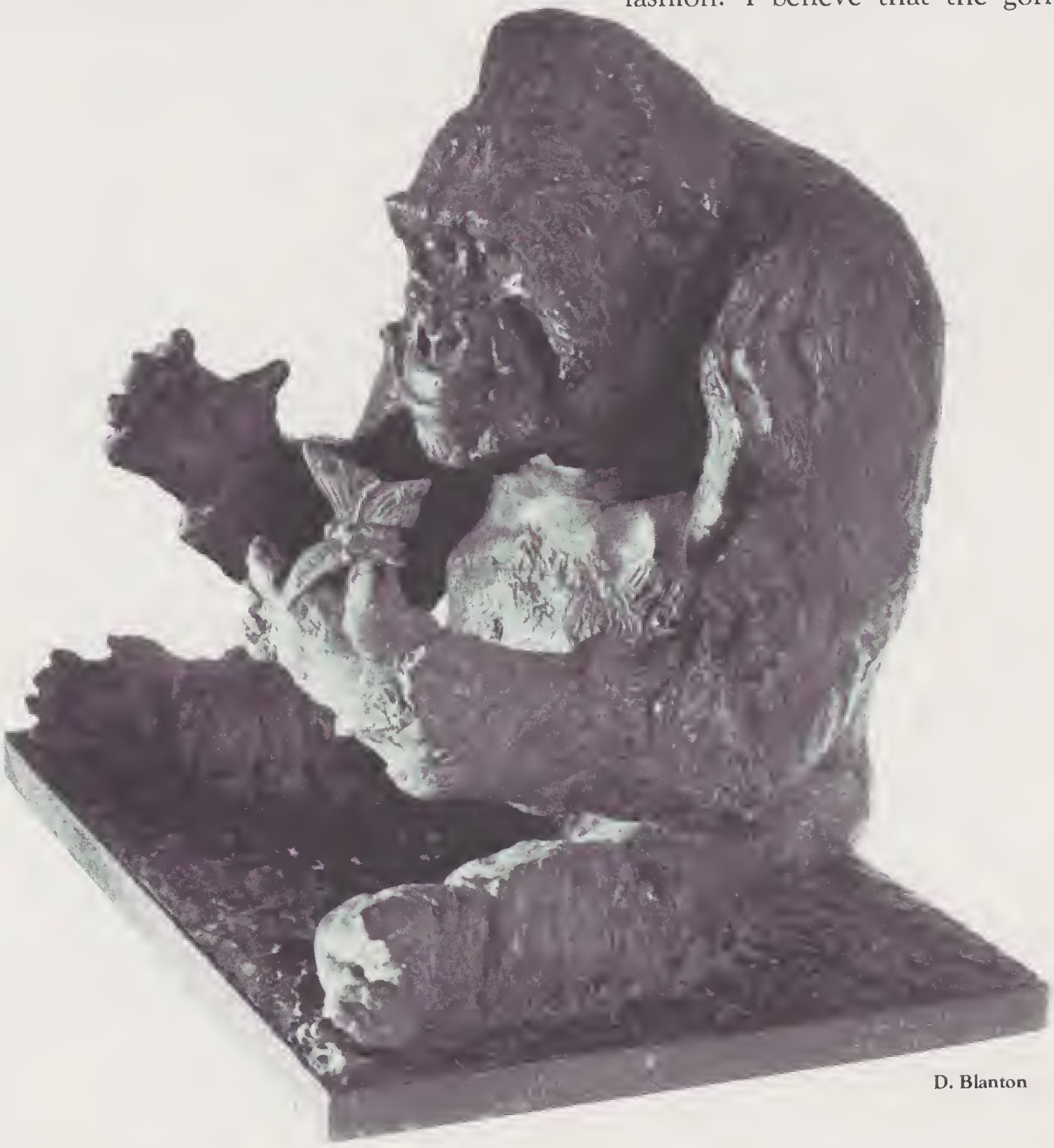
In one such audience sat Louis Agassiz Fuertes, ornithologist and bird artist who later would sculpt an amiable-looking gorilla contemplating a butterfly which rested on its hand. It was early in 1981 when, for the first time, I saw the replica of the bronze statue which is housed in the Laboratory of Ornithology at Cornell University. Throughout the summer of 1981 the memory of it haunted me until later in the year I returned to the Laboratory for another look. Seeing it again made me wonder even more how Fuertes was able to depict, with such sensitivity and accuracy, the gentle nature of the gorilla when it still maintained its ferocious reputation.

To understand the small bronze statue we must understand a bit about the nature of the artist himself. Louis Agassiz Fuertes was born in Ithaca, New York in 1874. He is remembered primarily for his technically precise yet strikingly vital watercolors of birds. Sympathetic down to the smallest detail, they reflect both the characteristics of the species and the uniqueness of the individual subject. Fuertes was well on his way to becoming a leading painter of bird pictures in 1911 when he first met Carl Akeley, an American naturalist, taxidermist, inventor, and sculptor.

Carl Akeley had first traveled to Africa in 1896 for the American Museum of Natural History as an assistant zoology curator. A lifelong friendship developed between the two men based upon their mutual commitment to the study of free-living birds and beasts. Akeley dreamed of a great African Hall for the Museum. He envisioned exhibiting at least 40 groups of African animals displayed against their natural habitats of plains and forests.

At the time of their first meeting Akeley had not yet seen gorillas in the wild but he was determined to return to Africa in order to film, study and collect mountain gorillas for his proposed hall. It may only be conjecture that Fuertes was, for the second time in his life, inspired by accounts of the gorilla although, unlike Du Chaillu's renditions, Akeley was convinced that the gorilla was essentially a gentle animal.

In Akeley's words: " . . . to the general theory of the ferocity of wild animals I have never been a convert. And the more I have seen of wild animals in Africa the less I have believed in their ferocity. Consequently I explained my creed concerning the gorillas in this fashion: I believe that the gorilla is



The butterfly communicates the gorilla's true nature.

D. Blanton

normally a perfectly amiable and decent creature. I believe that if he attacks man it is because he is being attacked or thinks that he is being attacked." Of the gorillas Akeley had seen in captivity, he remarked that they seem to want only "to be loved." Such remarkable acuity must have made an impression upon the sensitive Fuertes.

Between 1913 and 1920 Fuertes spent most of his time in Ithaca raising his family, painting and teaching at Cornell University. At the time he also collected, preserved and mounted a variety of butterfly species. One wonders how much the delicate butterfly perched on the hand of the bronze of the silverback gorilla is a whimsical touch characteristic of Fuertes's personality, and how much is a subtle means of discrediting the popular image of the gorilla as a horror monster. Certainly, the choice of the butterfly communicates more about the true nature of a gorilla than might have any other object Fuertes could have selected.

While Fuertes was engrossed in his work in Ithaca, his good friend Carl Akeley was preparing for his fourth trip to Africa. The 1921 expedition was to the Virunga Volcanoes in the Kivu Province of Zaire, then known as the Belgian Congo. Leaving the other members of his party behind in the relatively civilized town of Kissenyi, Akeley proceeded by foot to the base of Mt. Mikeno, one of the six dormant volcanoes of the Virunga chain. There, along with native guides, Akeley climbed the southwestern slopes of Mikeno and, judging from his descriptions of the terrain, they must have been very near what is known as the Kanyamagufa Canyon, a deep gorge on the slopes of the ancient mountain. Native legend claims a great fight had occurred there long in the distant past and the men killed were thrown into the chasm, hence the name Kanyamagufa, meaning "the place of bones." It was there that Akeley shot his first gorilla, an old silverback male. The following day, despite illness, he photographed, measured and preserved the specimen, in addition to making a death mask of its face. His compulsion to carry out the demanding tasks, despite a fever, was explained by his words, "... science is a jealous mistress and takes little account of a man's feelings."

Akeley's second specimen was an adult female and his third, the female's male offspring he estimated as about four years old. Akeley's accounts of the killings are filled with remorse as he considered himself "the savage and the aggressor." He was particularly disturbed by the young gorilla who, shortly before it died, was noted as wearing a "heartbreaking expression of piteous pleading." Although he could have killed many more gorillas, Akeley limited the number of specimens to the absolute minimum. The day after the second and third killings, Akeley again worked intently to preserve the specimens and make two more death masks.

On the fifth day Akeley and his guides left the steep slopes of Mikeno to move further south into the saddle area that lies between Mt. Mikeno and Mt. Karisimbi. His purpose for the move was to try to take motion pictures of the gorillas, a feat that was virtually impossible on Mikeno's steep slopes. That day he succeeded in taking the first moving pictures made of gorillas in the wild, a near-miraculous accomplishment made possible by his homemade movie camera. Akeley was able to shoot some 300 feet of film of an old female, her infant, and another young gorilla, all of whom seemed curious and surprisingly calm.

". . . to the general theory of the ferocity of wild animals I have never been a convert."

Akeley's fever worsened but, on the western slopes of Mt. Karisimbi at an altitude of roughly 11,000 feet, the last mountain gorilla of the 1921 expedition was shot. Two bullets were needed before the silverback, in his prime and weighing about 360 pounds, was killed and rolled down against the base of an *Hagenia* tree. That specimen was named "The Lone Male of Karisimbi."

Akeley wrote, "As he lay at the base of the tree, it took all one's scientific ardour to keep from feeling like a murderer. He was a magnificent creature, with the face of an amiable giant who would do no harm except perhaps in self-defense or in the defense of his friends." Akeley felt that the silverback had "unquestionably met white men before because at one time he had been badly wounded in the pelvis, leaving a permanent deformation of the pelvic region and a crook in his spine."

The following morning Akeley left the Virunga Volcanoes to return to America with his five mountain gorillas.

I have little doubt that the bronze is a mountain gorilla, rather than a lowland gorilla. The long body hair of the mountain gorilla subspecies has been carefully detailed by Fuertes. Also, his model has the extremely massive shoulder development, reduced length of neck, correct proportions between leg and arm lengths, broader and shorter hands and feet, and the outstanding head crest typical of the male mountain gorilla. Furthermore, examination of the death masks of each of the specimens as well as the photographs of the same animals has led me to believe that Fuertes's model for his bronze statue is based on "The Lone Male of Karisimbi:" the facial characteristics and the massive body are similar in both the specimen and the model. The unique crook in the back described by Akeley is also suggested. Five years before the physical characteristics differentiating mountain gorilla from lowland gorilla were available, Fuertes succeeded in portraying the mountain gorilla, not only anatomically, but in accordance with its gentle disposition.

"All I want to point out is that the gorilla should be judged by what he is, not by how the people that hunt him feel," wrote Akeley. Akeley's friend Fuertes did just that when he captured the intrinsic spirit of the beast in his mountain gorilla with a butterfly.

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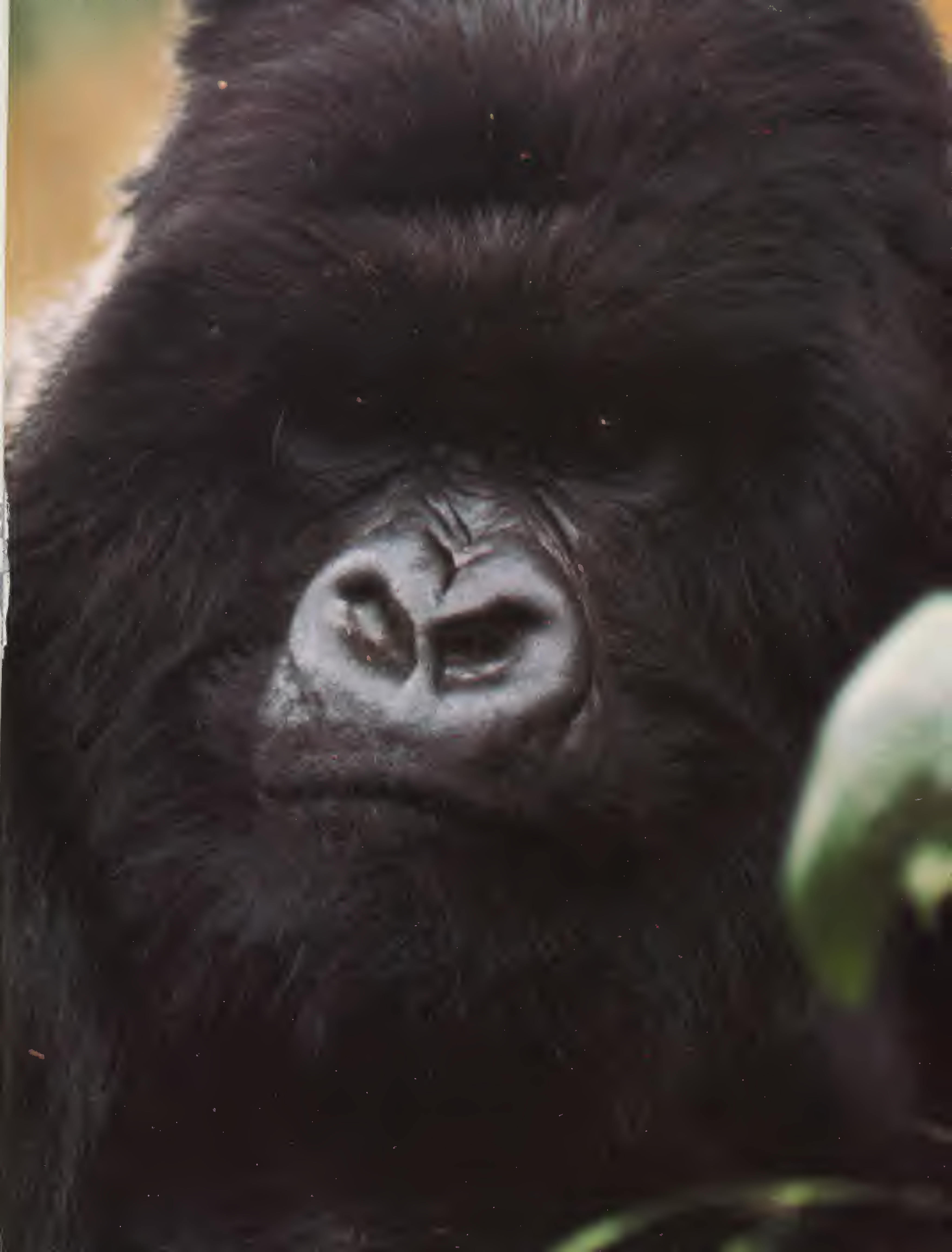
THE AUTHOR

In 1966 Dr. Dian Fossey was chosen by the late Dr. L.S.B. Leakey to conduct a long-term mountain gorilla study in the Virunga Mountains of central Africa. Under the sponsorship of the National Geographic Society, Dr. Fossey established the Karisoke Research Centre. She came to Cornell University in 1980 as a visiting associate professor.

Mountain Gorilla by D. Fossey, with permission, National Geographic Society.



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Black-necked stilt. Photo by Patricia Caulfield.

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Autumn/1982
Volume 1 Number 2

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FRONT COVER. Outside—White ibis, Everglades, Florida, in full breeding plumage. Photograph by Art Wolfe.

BACK COVER. Portrait of a black-crowned night heron. Photography by Gary R. Zahm.

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Dear Member:

Running a research project is like running a circus. Besides being a scientist, one has to be a showman, entrepreneur, personnel manager, car mechanic, electronics technician, animal caretaker, and fund raiser.

Research on bird navigation wasn't always this complicated. In the 1950s, Donald Griffin's investigations at Cornell required merely a helper and a few pigeons. It was not until 1967, under the leadership of William Keeton, that avian navigation studies at Cornell began to develop into an international enterprise. Bill foresaw that, in order to understand the navigational system, one must do multiple experiments over many years with thousands of pigeons. This meant technical assistants, vehicles, tons of pigeon food, computer time, and money. That Bill's vision was correct is attested to by the major scientific contributions he has made and by the constant support the project received from the National Science Foundation.

When Bill died in 1980, he left a large legacy of experiments, many nearly completed, some in need of additional investigation. In this issue of the Quarterly, I examine some of the questions raised by the work of Bill and others and bring you up to date on what we have learned about how birds migrate. We hope to continue our experiments and have more results for you next year.

CHARLES WALCOTT, *Executive Director*

Brian Harrington and red knot.

Untying the Enigma of the Red Knot

article by Brian A. Harrington
photographs by David C. Twichell

PEOPLE'S FASCINATION with bird migration goes back to prehistoric time. Since the Pleistocene, the changing of the seasons has been correlated with the migratory movement of birds. Although information has accumulated indicating where birds go and how they get there, little is known about why they follow certain routes in their travels between hemispheres. If birds migrate to get away from winter's cold weather, why don't all northern birds migrate south? And, considering the great risks and energy expended during migration, why don't they remain in the tropics instead of returning to their northern breeding grounds each year?

Learned and fanciful speculations abound, but proven ideas elude bird biologists. French ornithologist Jean Dorst said that we may never solve the riddle of bird migration, but it's fun to try. We at Manomet Bird Observatory are definitely trying. Our quest has taken us from the shores of Hudson and James Bay to the southern tip of South America, with stops in between in Massachusetts, New Jersey, and Florida. It has involved an extensive banding and marking program, intensive research into feeding habits, and a network of over 300 volunteers in 28 states and 20 countries and commonwealths who have observed and reported shorebird movement. Our study, although not yet complete, has yielded some insights into the reasons birds migrate.

Why Red Knots?

Shorebirds are one of nature's most spectacular long-distance travelers. Of the 50 species that nest in North America, over 25 spend the winter in South America, some flying more than 6,000 miles to reach the tip of Argentina. Of these 25 species, we chose the North American red knot, *Calidris canutus rufa,* for our study. When migrating they are found on both the Atlantic and Pacific coasts of North America. They breed principally on the islands north and west of Hudson Bay, and winter along the Argentine coast, with one small group wintering along the Gulf Coast of Florida. North American red knots are one of the stockiest and most colorful but least understood arctic members of the sandpiper family. However, they are ideal for migration research because the population is small, their wintering range is limited, and their route is narrow, making it possible for us to follow and study them.

Migration Routes

Our first research goal was to map the knots' major migration routes. To do this we relied upon our network of observers in North and South America, a banding program, and a large-scale effort of marking knots with yellow dye. We have banded more than 2,500 knots (including one which we have handled three times on two continents). Later, we searched through flocks at migration stopovers and wintering areas in the hopes of finding the colored plastic bands. (We have checked over 80,000 pairs of legs!) In this way we have begun to piece together a picture of the red knots' migration routes, and to estimate their world population.

After three years of following long cinnamon-colored trails of knots, we believe that the main group of about 150,000 knots winters in southern Argentina in a zone starting 800 miles south of Buenos Aires and stretching to Tierra del Fuego, which is only about 600 miles from the edge of Antarctica. A smaller group of perhaps 10,000 birds winters along the Florida west coast, with a few splinter groups spending that season elsewhere along the Gulf and Texas shore. All told, the North American red knot world population may be less than 200,000.

In spring the Argentina knots start northward somewhat later than most North American shorebirds, moving toward southern Brazil, where William Belton, chairman of the Pan American Section of the International Council for Bird Preservation, found peak numbers in late April and early May. From there we lost track of the route, but picked it up a week later on the coast of the southeastern United States. Are knots flying 5,000 miles non-stop from southern Brazil to the Georgia and Carolina coast?

Judge Herman Coolidge of Atlanta describes a flight he witnessed at Wassaw Island, Georgia, on May 22, 1971.

"On Saturday morning we rode the beach in a jeep and quickly realized we were seeing the largest flight of knots we had ever seen. Wave after wave of these birds in their reddish cinnamon-colored plumage passed us. All were moving northward at a leisurely rate, stopping frequently to feed or rest. We rode the beach for several hours in an effort to estimate their numbers. I am confident we did not exaggerate when we concluded we had seen at least 12,000 birds."

Coolidge apparently saw the last of the 1971 knot flight in Georgia for our work has shown that the mean date for knot migration in that region is May 12. From the southeast coast knots move steadily northward, finally gathering at a major feeding area along the Delaware Bay shore of New Jersey, with numbers building until the last of May. Their route turns north and inland at this point and in non-stop flights they move north in late May and early June to James and Hudson Bays in Canada, and then to their arctic breeding grounds.

The itinerary for knots migrating from Florida is less clear. The largest flocks of 1,000 to 2,000 birds gather between October and January on the west coast between Clearwater and

Above: *Bird in the hand: care is taken when removing red knot from rocket net.*
Below: *A red knot parade marches down the beach in Sarasota, Florida.*

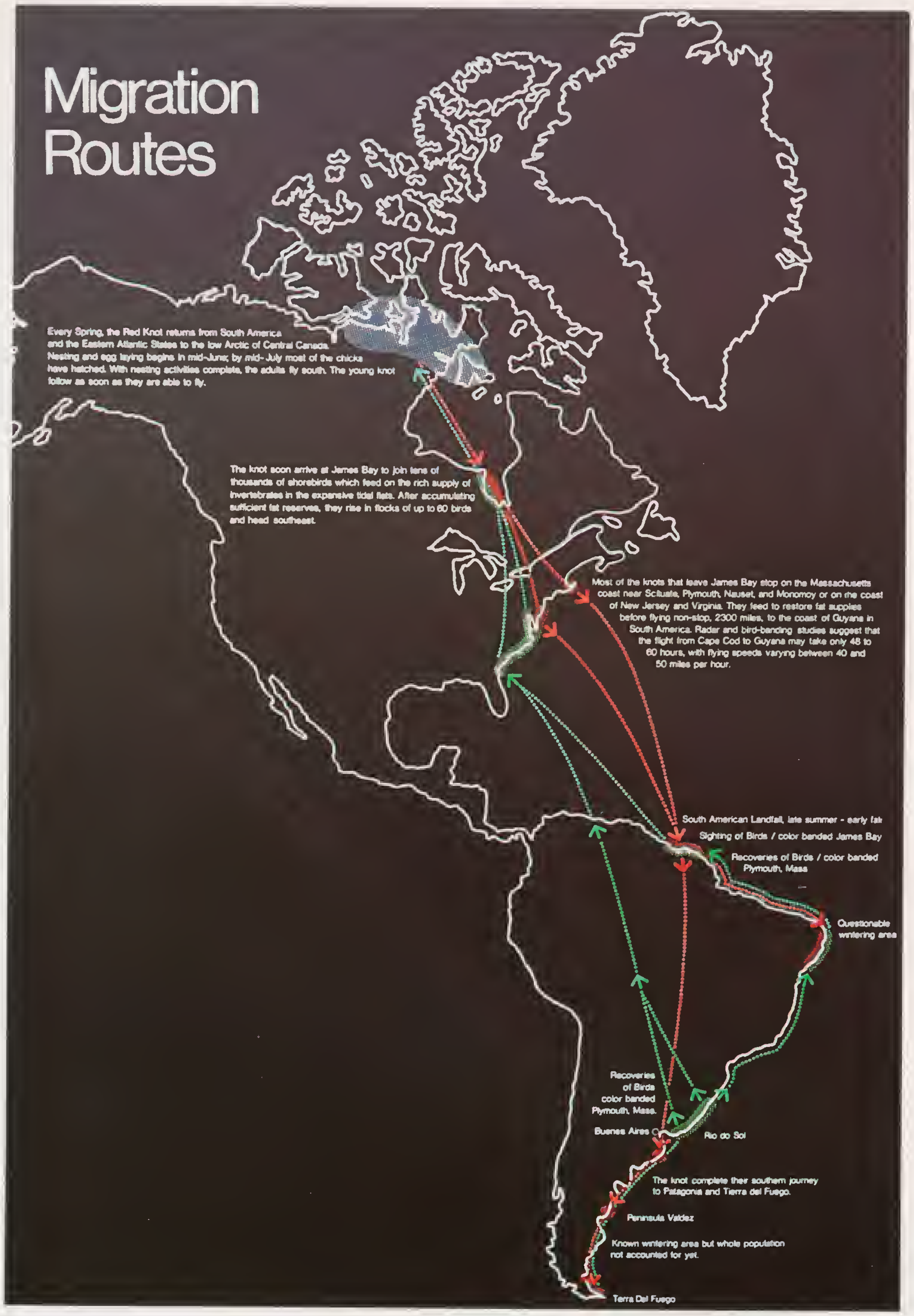
Charlotte Harbor. The main group is in the St. Petersburg/Sarasota area until February when it starts dispersing. Marked birds then appear as far south as Naples but, simultaneously, flocks of several hundred also show up in the Jacksonville area. By the end of March, 5,000 knots can be found near St. Augustine, apparently having flown across Florida as they begin their gradual northward migration to James Bay and the arctic. Interestingly, this movement occurs at about the same time knots in Argentina start their northward journey. The Florida and Argentina groups merge during early May along the southeastern Atlantic coast, before moving northward to the Delaware Bay area.

The annual spring gathering of knots on the Delaware Bay shore is perhaps the greatest shorebird spectacle in North America. Linda Leddy, a Manomet shorebird researcher, wrote on May 25:

"The scene is primeval . . . hundreds of thousands of horseshoe crabs crawl on the shore to lay their eggs on the highest new or full moon tide in the last half of May. The coast appears to be paved with cobbles, each one a horseshoe crab clambering to secure the right spot for laying its eggs. Add to this scene tens of thousands of gulls, sandpipers, and dense flocks of knots, all lined up along the shore to feast on crab eggs. It's amazing that the revolution of the moon around the earth, the reproduction of horseshoe crabs, and the hemispheric migrations of shorebirds are all so closely linked."

By sunset, small groups of knots start breaking away from the main flock and, steadily gaining altitude, they head toward their breeding grounds in the far north.

A few days after arrival in their arctic breeding zone, the knots form pairs and establish territories. It is late May and the ground is still covered with patches of snow. However, the melt follows rapidly and as more insect prey emerges, life becomes easier for arctic nesters. Although the habits of nesting red knots are not fully known, the young probably start hatching in early July. Leaving the males to care for the still flightless young, the females begin their long migration south. They are followed by the males about two weeks later, and a month after that by the juveniles.


Migration Routes
South American Landfall, late summer - early fall
Sighting of Birds / color banded James Bay
Recoveries of Birds / color banded Plymouth, Mass
Questionable wintering area
Recoveries of Birds color banded Plymouth, Mass.
Buenos Aires
Rio do Sol
Peninsula Valdez
Terra Del Fuego

Every Spring, the Red Knot returns from South America and the Eastern Atlantic States to the low Arctic of Central Canada. Nesting and egg laying begins in mid-June; by mid-July most of the chicks have hatched. With nesting activities complete, the adults fly south. The young knot follow as soon as they are able to fly.

The knot soon arrive at James Bay to join tens of thousands of shorebirds which feed on the rich supply of invertebrates in the expansive tidal flats. After accumulating sufficient fat reserves, they rise in flocks of up to 60 birds and head southeast.

Most of the knots that leave James Bay stop on the Massachusetts coast near Scituate, Plymouth, Nauset, and Monomoy or on the coast of New Jersey and Virginia. They feed to restore fat supplies before flying non-stop, 2300 miles, to the coast of Guyana in South America. Radar and bird-banding studies suggest that the flight from Cape Cod to Guyana may take only 48 to 60 hours, with flying speeds varying between 40 and 50 miles per hour.

The knot complete their southern journey to Patagonia and Tierra del Fuego.

Known wintering area but whole population not accounted for yet.

Charles Beier

In Massachusetts the first influx of knots appears about mid-July, with numbers peaking during the first week in August. At Scituate, where we have banded and observed thousands of knots, we have seen individuals we had banded several months earlier in Argentina, as well as others we had color marked in Florida and New Jersey.

The duration of their stay on the Massachusetts coast is about two weeks, and during that time the Argentina-bound knots feed voraciously, sometimes doubling their weight. When they have acquired the necessary fat and favorable weather arrives, they head out over the Atlantic on the long non-stop flight to South America. The exact point of their landfall is not known, but it is probably near Surinam or Guyana. After about a month there, feeding and fattening, our best guess is that they fly without stopping across Amazonia, making an Atlantic landfall somewhere south of Buenos Aires.

Imagine the excitement of finding a knot marked in Massachusetts on a remote tidal flat in the wilds of the central Argentina coast. Laura Payne, an intern at Manomet who helped to band and dye knots in Massachusetts, did just that:

Knots captured by rocket net wait to be measured, weighed, banded, and released.

"... I have fantastic news. I *did* see 10 red knots yesterday and one of them had a suspicious-looking yellow rump. You can just imagine my surprise. I started jumping around the beach because of a *correlimos* with yellow dye... any onlooker would have been quite shocked. I must add that I am positive that it was a red knot and it had a yellow rump and undertail coverts... *Estoy exuberante!* (I am exuberant.)"

Meanwhile, the knots that winter in Florida have begun their seemingly less rigorous southward migration, moving slowly through Massachusetts during July, down the United States Atlantic coast, until they arrive in the Jacksonville/St. Augustine area in early September. Only a few are seen farther south on the Atlantic side. However, large flocks appear on the west coast in the Sarasota area at about this same time.

It is interesting to note that knots marked in Massachusetts and others banded in New Jersey have been spotted in Florida, but no Argentina knots have ever been detected there. Conversely, no Florida knots have been seen in Argentina. These observations, plus the fact that banded knots return to Florida year after year, show that Florida knots are a discrete wintering group. It is still a riddle why one group chooses Florida and another Argentina as its winter haven. We're continuing to look for the answer.

Food, a Knotty Problem

Knots fly and feed in tight flocks. George Mackay, noted naturalist of the last century, referred to these flocks as "clouds" having "numbers so high that estimates were useless." This characteristic rendered them particularly vulnerable to hunters, who not only shot them in large numbers, but slaughtered thousands by fire lighting, a method used to collect knots by the barrel for shipment to eastern city food markets. By 1893 Mackay feared that they had been reduced to the point of extinction. In 1927, Massachusetts ornithologist Edward Howe Forbush, reported that "most of my Massachusetts correspondents never see the bird now." Fortunately, knot numbers are much higher today, thanks in large measure to the Migratory Bird Treaty Act of 1918.

If flocking made knots vulnerable in the past, it is this reason that they are vulnerable today. Knots are specialized feeders whose energy needs cause them to seek concentrated, rich food resources which they find in small bivalves, crustaceans, and marine worms. In James Bay the main prey is Macoma clams. In Florida it is small, brightly colored Coquina clams, and in Massachusetts and Argentina it is mussel spats which dot the sod banks and mud flats of a few select New England estuaries, or cluster on a unique Argentinean shoreline formation called *restinga.*

The results of our banding and surveys suggest that the limited number of locations where these food combinations exist is one problem to knots. But also, when not feeding, they need a nearby area to preen and rest while having good visibility for early detection of predators. The number of such stopover places is small along the migration route. Knots use a few sandy beaches in Florida and Argentina, two or three quiet harbors and estuaries in New England, and two sites on the New Jersey shore. These same spots have become increasingly popular for human recreational development, threatening the special needs they fulfill for knots. This predicament is just as serious as the fire lighting of the 19th century.

If food is the knots' weakness, it is also the logical explanation of the migration riddle. Our research shows that knot migrations are hemispheric journeys from lunch table to lunch table; the blush or peak of the Macoma, Coquina, or mussel spat crop is predictable. Year after year new crops of these bivalves have a season when they appear in extraordinary numbers and are just the right size for knots to eat. It can't be an accident that the knots appear in equally extraordinary numbers just when this seasonal flourishing reaches a peak. The patterns and timing of knot migration from Tierra del Fuego to the arctic reflect a coordination that must have developed over the eons on a remarkable geographic scale of trial and error.

If stopover areas for knots and other migratory shorebirds are lost, are there others that can replace them? The answer appears to be no. The situation needs the attention of all those interested in seeing flocks of these fine birds continue to ply their way across the hemispheres.

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Homing with Map & Compass

by Charles Walcott

OF ALL THE WORLD'S long-distance animal migrants, birds are the most famous. The Arctic tern is well known for its ability to nest above the Arctic Circle and then migrate south, far below the tip of South America. The Pacific golden plover performs an even more spectacular journey, with its wintering range some 10,000 miles wide and about 8,800 miles south of its arctic breeding grounds.

How do these birds find their way? The answer seems to involve two distinct yet interrelated systems. One is the birds' "compass" and the other is their "map." Together, these two processes may be the means birds use to find home.

Suppose you are in a rubber raft in the middle of the ocean and someone gives you a compass. In which direction would you paddle? The compass is useless unless you know whether you are on the Atlantic, Pacific, or Indian Ocean; you need to know where you are in relation to home. What you need is a map of where you are so you can position yourself correctly. Similarly, birds have to know where they are and where they are going.

We who explore bird migration have taken a few divergent paths ourselves in search of the solution to its mystery. Many of my ornithological friends look down their noses at pigeons, even homing pigeons. But we would be even more lost without them. For the researcher they are convenient; they return faithfully, bring the experimental apparatus with them, and enjoy nothing as much as producing more pigeons. In addition, they are desirable subjects because they have been bred for their ability to orient themselves, then find their way home. This is a real advantage in the arduous tasks we put them through.

Consider the puzzle a homing pigeon faces: it is taken from its loft in a covered basket and released at some totally unfamiliar place. It doesn't know where it is. It doesn't know where home is. What is it to do? First it must answer the question—which direction is home? Once it has determined that home lies to the north, for example, then it seems to use a compass to find that direction. Pigeons may have not one but two compass systems. They seem to prefer the sun when it is visible and the earth's magnetic field when the sun is not shining.

How do we know this? Researchers have performed experiments in which pigeons were confined to a box where the lights were out of phase with the real day by six hours: the lights went on at noon and off at midnight, resulting in the birds' internal clock falling behind real time by six hours. When it was really noon, the pigeons thought it was 6 a.m. When these "clock-shifted" birds were released they flew off at 90 degrees away from the direction of home. Why? Because they were using the sun as a compass.

The sun rises in the east, is south at noon, and sets in the west. Pigeons apparently know this too, so when they want to fly east in the morning they fly toward the sun. Our experimental birds were released at noon, but because they were clock-shifted, they thought it was 6 a.m. and behaved appropriately by flying 90 degrees off course. However, this mistake occurred only when the sun was shining. Under cloudy skies, the clock-shifted birds flew straight home. Clearly they were no longer using the sun as their compass.

What were they using? We have long suspected that birds use the earth's magnetic field and here at Cornell the late William Keeton experimented with pigeons under Ithaca's frequent and dense overcast. He glued small magnets to the pigeons' backs. When the sun was not visible, the magnets often disoriented them, indicating that they couldn't use the magnetic field properly.

To test this point another way, Robert Green from the State University of New York at Stony Brook and I put coils around the pigeons' heads and ran a small, harmless electric current through the coils. That allowed us to control the magnetic field around the pigeons' heads. By reversing the battery in its holder, we could reverse the direction of the current through the coils and so reverse the direction of the magnetic field. Thus the same coil could either result in a magnetic field that was a Nup (north up) or a Sup (south up) depending on which way the battery was connected.

Pigeons with Sup coils released under overcast skies headed toward home, but birds with Nup coils flew away from home as long as the sun wasn't out. When the sun was shining we couldn't fool them. This is evidence that pigeons can use two compass systems, the sun when it is visible, or the earth's magnetic field when it is not.

Now that we are fairly certain of the compass, we are trying to figure out the birds' mysterious map. Before a homing pigeon can effectively use its compass, it must decide which direction is home. But how do pigeons know where they are in relation to their loft?

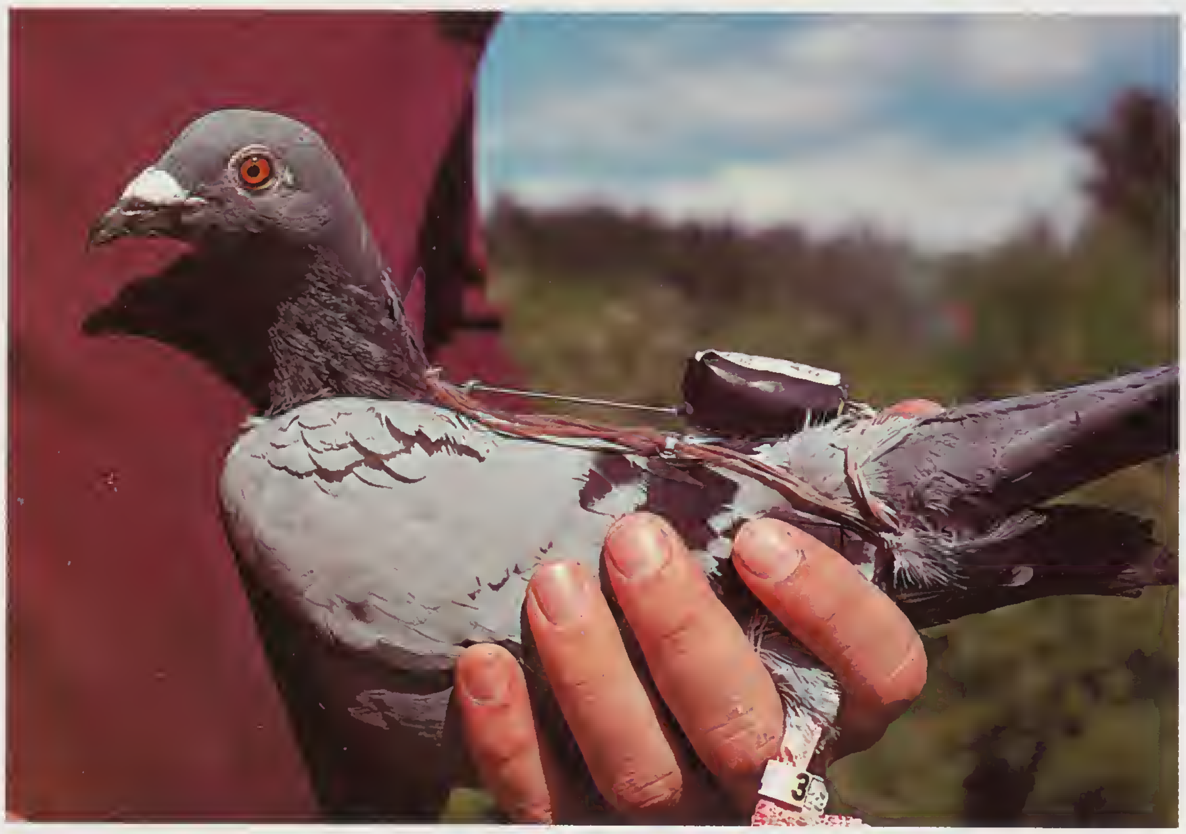
Pigeons fitted with opaque contact lenses had no trouble becoming oriented and finding home. Pigeons released over the ocean, out of sight of land, also found their way without difficulty. Both of these experiments indicate visual landmarks are not very important. And the good orientation often seen under overcast rules out the sun or stars. What is left?

There are currently two major theories. A group in Italy, led by Floriano Papi of the University of Pisa, and Hans Wallraff in Germany, have proposed that pigeons use familiar odors to find the loft. J. Gould at Princeton, Bruce Moore at Dalhousie University in Nova Scotia, W. Wiltschkos in Germany, and A. Lednor and I at Cornell, think that the earth's magnetic field plays the key role.

Papi and his colleagues have performed many ingenious experiments

Blue 70 returns to the loft and prepares to go through the hanging "bobs" of the trap. The bobs keep the bird from leaving.

L. Snyder



C. Walcott

D. Smith

Above: *A pigeon carries a radio transmitter and battery packs mounted on a small wire and rubberband harness. With these, researchers can follow the bird's direction.*
Right: *Walcott equips pigeon with a transmitter while Lee Snyder records information about where the pigeons vanish into the horizon. The other pigeons watch with interest.*

which support the idea that pigeons use odors as the basis of their map. Papi's idea is that pigeons learn to correlate the odors around their loft with the directions of the wind. Sitting in the loft the bird learns, for example, that a chocolate factory lies to the north, the sea to the south, an olive grove to the east, and a Fiat plant to the west. In this way the pigeons develop an olfactory map of their surroundings. When released at a new location, they sample the local odors, remember what wind direction brought it to them at the loft and then fly in the appropriate direction.

At first this seems an improbable theory, but three types of experiments seem to support it: (1) Papi has interfered with the pigeons' ability to use their sense of smell, (2) he has manipulated odor cues during the pigeons' trip to the release site, and (3) he has altered the wind direction around the home loft.

In each case Papi reports that the results of the experiments support the olfactory hypothesis. But a skeptic looking at these experiments can frequently find other, non-olfactory, explanations. The earth's magnetism, for instance, could be producing some of the results. Only one Italian technique, the "deflector loft," has had the same effect in Italy, Germany and Ithaca.

The deflector loft is a small slatted aviary with four large panels that deflect, by 90 degrees, the incoming winds from all directions (see diagram). For example, a wind from the north hits a deflector panel and the pigeons in the loft experience the wind as coming from the west. A pigeon raised in such a loft should have its olfactory map rotated by 90 degrees. And that seems to be what happens. When released, pigeons that have been raised in deflector lofts vanished about 90 degrees away from home, in exactly the direction that the olfactory hypothesis would predict.

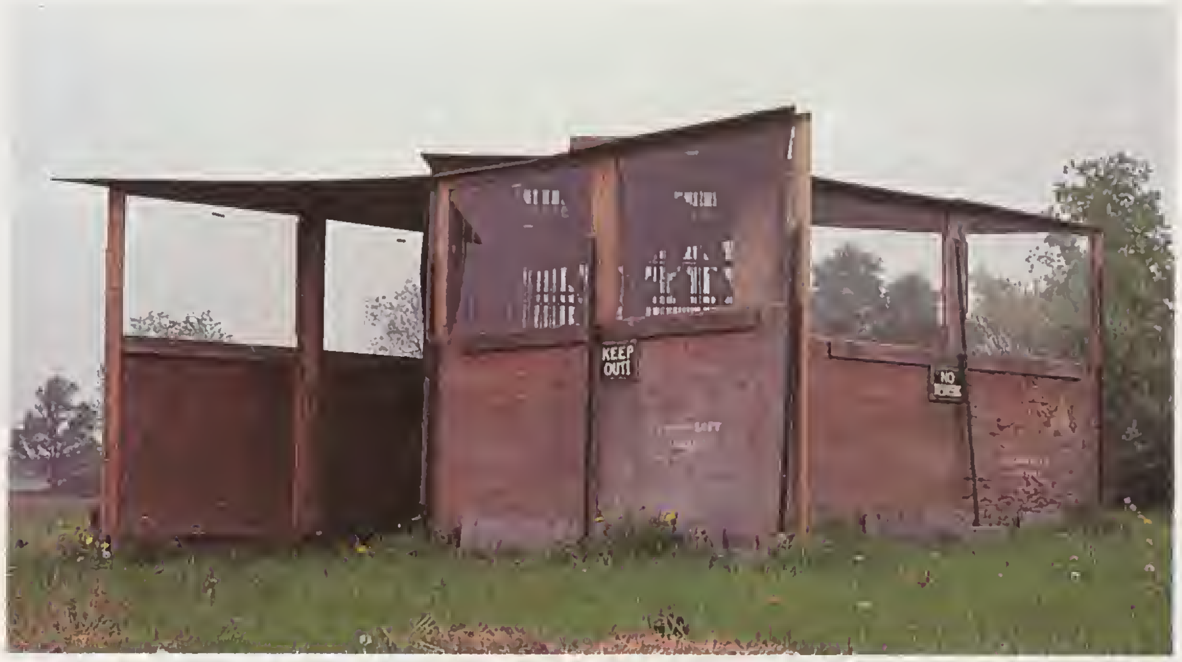
However, further investigations by Jerry Waldvogel and John Phillips

Right: *Pigeons inside loft experience wind.*

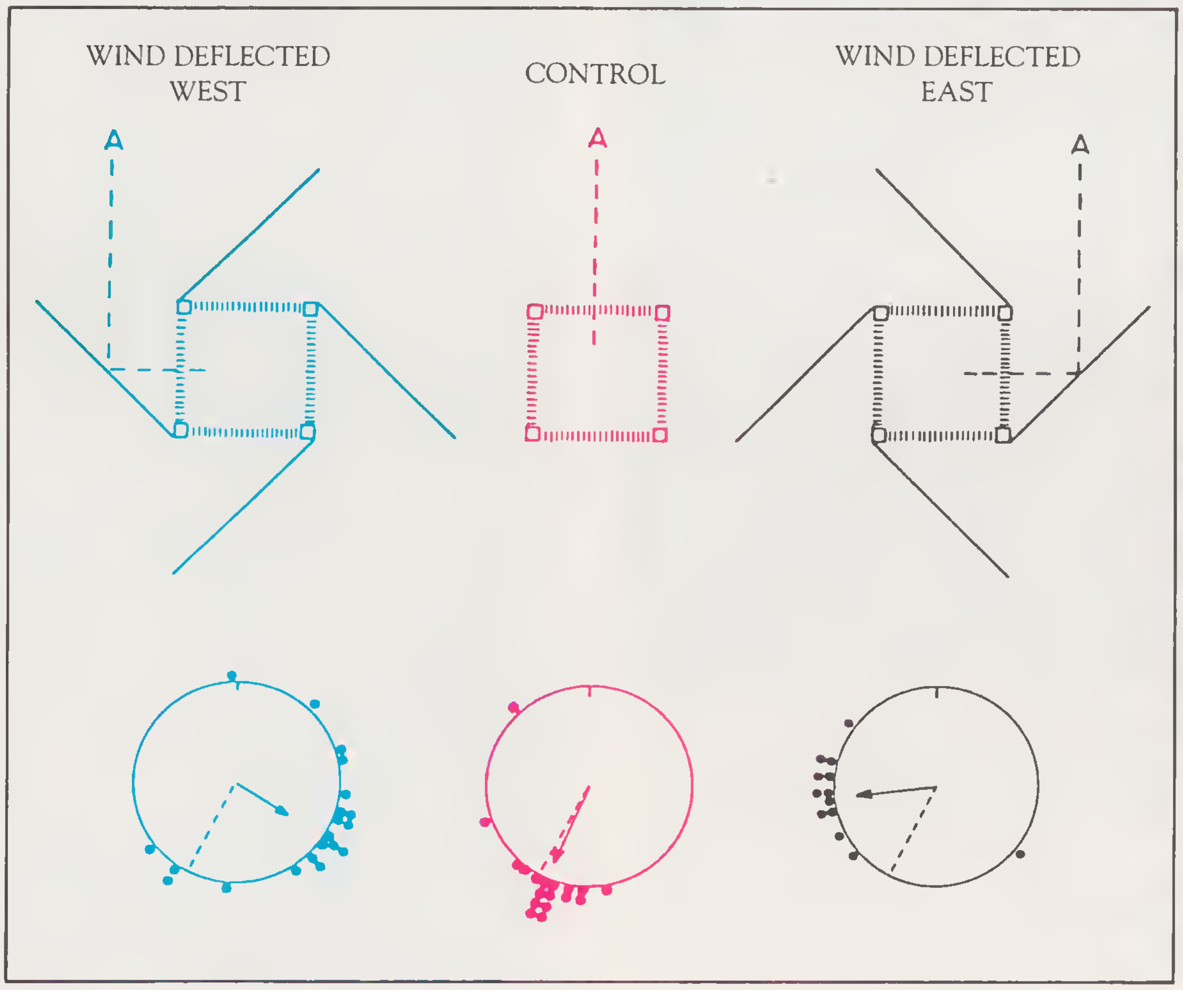
Diagram Top: *Deflector loft experiment. Control = red. Lofts with deflectors = blue and black. Winds from the north presumably carrying odor. "A," enter control loft from the north, but winds enter the other lofts from the east and west because of the deflectors.*

Bottom: *Bearings of pigeons. Control birds (red), which had experienced normal airflow, oriented properly. By contrast, the birds which had experienced "A" winds from the west (blue) oriented more easterly, and the birds which experienced "A" winds from the east (black), oriented westerly. Each dot = vanishing bearing. Dotted line is direction of home.*

Bottom Right: *Martin Michener tracks a pigeon using radio telemetry.*



C. Walcott



A. McD. Davis

C. Walcott

Homing pigeons are bred for their ability to return home from great distances. For the researcher they are convenient. They return faithfully and bring experimental apparatus back with them.

at Cornell showed that it was probably the deflector panels themselves that were causing the effect. The panels, made of plexiglas, not only deflect wind, but also reflect sunlight. At the moment, Waldvogel and Phillips think that the deflector loft effect is, at least in part, due to the reflection of light which affects the pigeons' sun compass, not the deflection of wind and the odors it carries.

All in all, it looks as if the olfactory hypothesis is still very much an open question.

If pigeons are not employing odors, could they be constructing their map using the earth's magnetic field? As mentioned before, there is some evidence that they use it for a compass. To understand how birds could use the earth's magnetic field for orientation, consider the earth to be a grapefruit with a bar magnet poked through the middle. If you remember from playing with a bar magnet, thumbtacks and paper clips are attracted to either end of the bar, but not to the middle, an indication that the magnetic field is strongest at the poles of the magnet.

The same is true of the earth. The magnetic field is strongest at the north and south poles and weakest at the equator. Thus, information about one's position north and south could be derived from the strength of the earth's magnetic field if one were sensitive enough to detect it. However, it is hundreds of times weaker than what your finger feels when placed between the tips of a common horseshoe magnet. It is hard to imagine that a pigeon could sense infinitesimal changes in the strength of the magnetic field as it travels to its home. Yet, evidence is mounting which shows that this may be what is happening.

In the 1940s Henry Yeagley from Pennsylvania State College reported that pigeon races were often slower on days following magnetic storms. Bruno Schreiber from the University of Milano in Italy recently reported similar results.

Keeton and his colleagues did an extensive series of pigeon releases in which the same birds were set free at the same site day after day for an entire summer. When they examined the average direction in which the pigeons vanished into the horizon, they found that this direction varied from day to day, and that the variation correlated with even slight changes in the earth's magnetic field.

In September, 1975, I gave a seminar at Rhode Island College and Philip Pearson of the biology department asked whether pigeons were disturbed when released at magnetic iron deposits. The earth's magnetic field should be distorted in such areas and Dr. Pearson suggested that if the birds are affected by magnetic storms, then they might have trouble homing from magnetic anomalies. Since Dr. Pearson kindly furnished us with the location of a huge magnetic anomaly, Iron Mine, near Woonsocket, Rhode Island, we released some pigeons there. The birds were totally disoriented! Yet, once they flew outside of the disturbed area, they found their bearings and homed normally. These surprising results led us to release more pigeons at other anomalies both stronger and weaker than Iron Mine.

What we found was that the stronger the magnetic anomaly, the more difficulty the pigeons had orienting toward home, suggesting that the disturbed magnetic field caused their disorientation.

One more piece of evidence corroborates the involvement of the earth's magnetic field in pigeon orientation. My brother, Ben, and I have discovered that pigeons' heads contain iron-rich tissue. Whether it is magnetic and the receptor with which pigeons pick up their magnetic information, remains to be seen, however, the finding seems to point in that direction.

Only time and further experiments will tell what information the homing pigeon uses to find its way over hundreds of miles of unfamiliar territory. And when we know more about pigeons, perhaps it will help us to understand how a Manx shearwater, released in Boston, found its way across the Atlantic Ocean to its home on the coast of England in only 12 days.

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THE AUTHOR

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Seeds & Shrubs:

article by **Charles R. Smith**
artwork by **Jack Lambert**

THE BEST REASON for feeding birds is the sheer enjoyment of seeing them close up and observing them going about their everyday lives. The degree to which the birds themselves benefit from our efforts remains unclear. Although we would like to think that our feeding wild birds will result in more of them surviving to nest and produce young, this, in fact, is yet to be confirmed. On the other hand, there is no conclusive evidence that feeding is harmful, either. For those of us who derive pleasure from watching birds at the feeder, we can easily concentrate large numbers and varied species by providing them with proper food.

Until recently, there was little carefully collected and evaluated information to guide us in our selection of seeds to feed birds. Now, thanks to A. D. Geis of the Patuxent Wildlife Research Center, U.S. Fish and Wildlife Service, we are better informed.

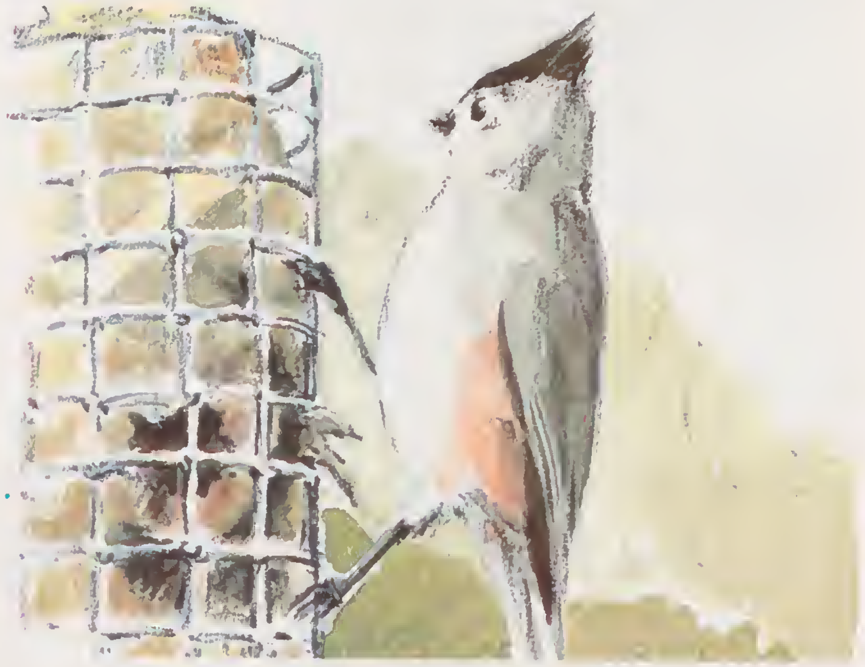
One fact that Geis uncovered in his research is that feeding preferences among various bird species can be strikingly different. As a result, it is difficult to find a single seed mixture that would be suitable for all birds at all places and at all times. However, the birds Geis studied did make definite choices which we can use to guide us when we shop for seed.

Among the larger seed-eating birds, such as the cardinal, sunflower seeds of various types were by far the most favored food. That preference extends to some of the smaller seed-eating birds too, including chickadees, titmice, and nuthatches. Of the types of sunflower seeds available, the smaller, thin-shelled oilseed was the most attractive. Other varieties of sunflower seeds tested and found to be popular were gray-striped and black-striped versions. For the smaller seed-eating species, such as many sparrows and juncos, white proso millet was well received. Red millet and milo, commonly found in commercial mixtures, were less appealing. These "red seeds" are added to the mix because they are less expensive than sunflower seeds and white proso millet, so they keep the price low. But, since the birds did not readily eat them, their value in the mix is questionable.

In Geis's study, cracked corn was attractive to white-throated sparrows, dark-eyed juncos, cardinals, mourning doves, and tree sparrows. Finely cracked corn was eaten more readily than its coarsely cracked counterpart.

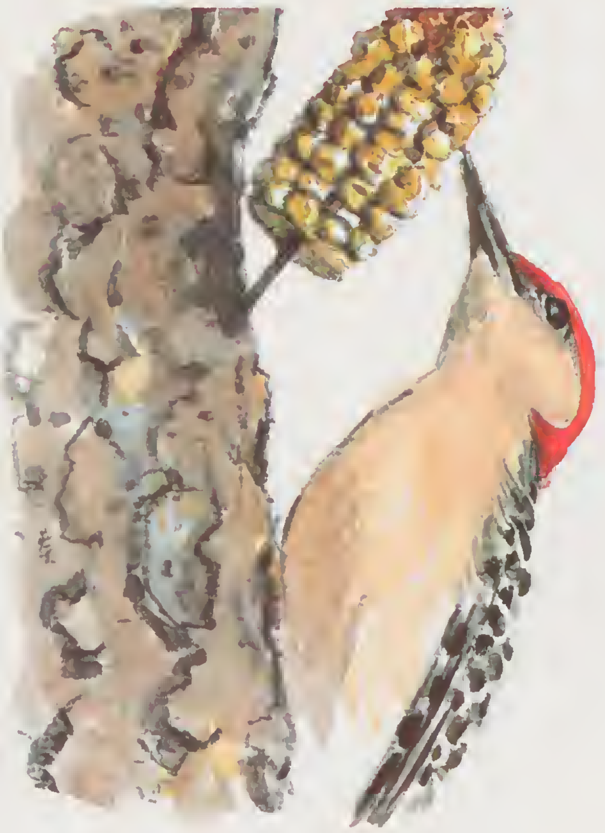
Thistle seed, also called niger seed, though expensive, is excellent for attracting American goldfinches. It is also very popular among siskins and redpolls. If thistle seed is too costly, many of the small seed-eating birds will accept white proso millet instead.

In choosing commercial seed mixes, look for those with a high proportion of sunflower seeds and white proso millet, along with finely cracked corn. Avoid mixes with a lot of the unpopular red millet and milo. Where available, the small, black, oil-type sunflower seed is the best choice. Where it is not on the market, the larger types of sunflower seeds are the next best choice. You might want to purchase sunflower seeds, white proso millet, and cracked corn separately and prepare the mixture yourself.



Black-crested Titmouse

Two Strategies for Feeding Birds



Red-bellied Woodpecker

Attracting birds to your yard with commercial seed mixes and suet is fun, but can be expensive and time consuming. If you do not own the property on which you live, it may be your only option. But, if you are a property owner, I recommend that you invest in plantings that will provide a long-term source of food and shelter for the birds in your area. A good planting scheme can be a continuing joy that will return dividends on your investment.

Some general considerations apply to plantings for attracting birds no matter where you live. A good planting scheme should integrate three types of plants: evergreens, perennial herbs, and fruiting shrubs.

Evergreens, such as conifers, provide cover for birds all year round. In cold weather, evergreens are especially valuable as shelter from the sleet, snow, wind, and cold. I would choose native wild plants in any landscaping plan designed to benefit birds. Many native species already are adapted to the local diseases, insect pests, and climate to which they would be exposed, so they usually remain healthy and require little care. Nurseries commonly carry a wide selection of native species.

Perennial herbs in the composite family (which includes sunflowers) produce an abundance of the small seeds favored by many winter finches. You might consider encouraging the growth of goldenrods and asters; in the northeast, fields of these plants abound with siskins, goldfinches, and redpolls during "invasion winters" when they feed on the tiny seeds the plants produce.

In addition to evergreens and perennial herbs, shrubs of different heights that offer birds an assortment of fruits can be very successful. Recently, E. W. Stiles of Rutgers University classified a number of fruiting shrubs according to the quality of their fruit as food for birds. Among fall fruit-producing shrubs, Stiles identified the following as high-quality: alternate-leaf dogwood, *Cornus alternifolia;* silky dogwood, *Cornus amomum;* flowering dogwood, *Cornus florida;* red-panicle dogwood, *Cornus racemosa;* burningbush, *Euonymus atropurpureus;* running strawberry-bush, *Euonymus obovatus;* common spicebush, *Lindera benzoin;* alderleaf buckthorn, *Rhamnus alnifolia;* and sassafras, *Sassafras albidum.* Incorporating these shrubs into your planting scheme can provide a valuable source of high-energy food for many species of migrating and resident birds in the fall. Also, you might want to participate in the Backyard Wildlife Habitat Program of the National Wildlife Federation. In this you receive specific guidelines for certifying your property as backyard wildlife habitat by the N. W. F. For details write to N. W. F., 1412 16th Street, N. W., Washington, D.C. 20036.

A long-term project of growing bird-attracting plants on your property, to complement your normal bird-feeding efforts, will not only enhance its beauty, it will be of value in a more important way. As we continue to cut large tracts of forest and further encroach on wildlands with urban development, all of our efforts to provide suitable habitat for birds will be of increasing significance.

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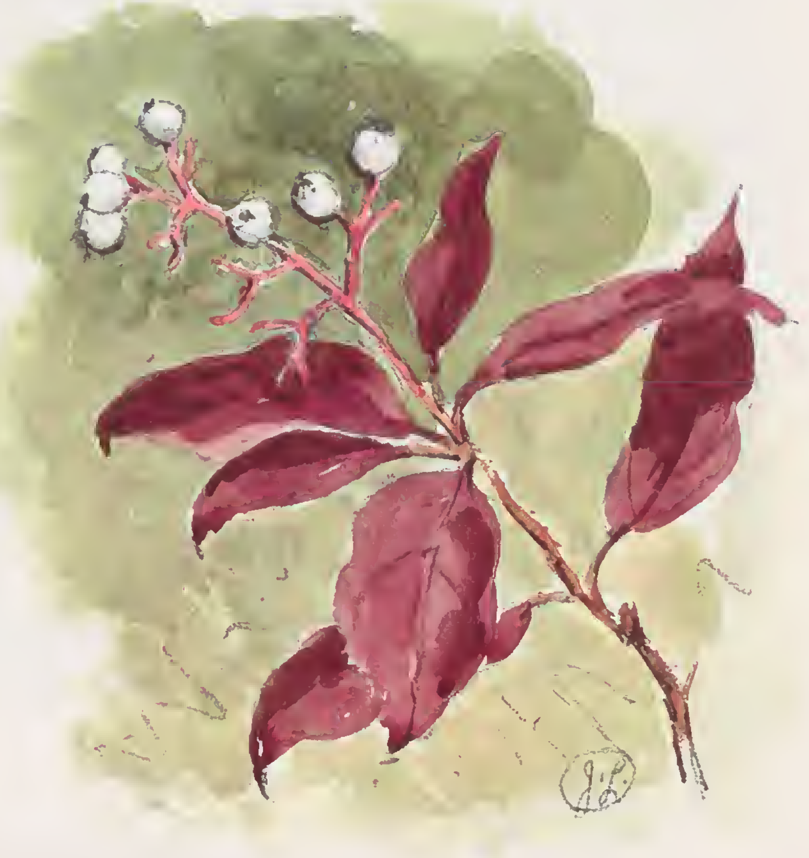


Red-panicle Dogwood, Cornus racemosa

Turkey Watching

by Richard E. Bonney, Jr.

painting by Roger Tory Peterson

"illuminated by a tentative afternoon sun were two huge gobblers"

MANY OF US THINK of turkey primarily in terms of food. The approaching Thanksgiving season especially brings to mind thoughts of the succulent bird served with all the trimmings. Yet there is another side to the turkey: the wild side. While our domestic dinners repose on the table, most of their wild cousins have escaped a fate surrounded by cranberry sauce, and are out in the woods where dedicated bird watchers can catch a glimpse of them.

Viewing these wary birds in their natural setting is no small feat. Their woodsy habitat and keen senses combine to make turkey watching a real challenge. However, knowing a bit about their habits and location may assist you in tracking them down.

The most exciting time to watch for wild turkey, *Meleagris gallopavo,* is in early April when increasing daylight and warm temperatures send sex hormones coursing through the male turkey's blood. His ensuing courtship displays, usually performed during clear, warm mornings, are a breathtaking sight. His head adornments fill with blood and become crimson. Then, with tail and wing feathers fanned and wing tips pressed to the ground, he struts back and forth gobbling loudly.

A RECEPTIVE HEN responds with clucks or yelps. Sometimes she seeks out the tom; sometimes he must go to her. As morning progresses the male may accumulate a harem of several hens. Breeding continues through spring, the harems slowly dwindling as the bred hens leave to build nests.

Social interactions surrounding mating differ among the various wild turkey subspecies. In some, males are solitary during the breeding season, although two or more toms may breed the same harem. In others, males travel in flocks, and only the dominant male displays and breeds the hens. While he is mating, his flockmates defend the harem from other males, and sometimes fights occur.

During fall, after the rigors of mating and raising young are past, turkeys begin feeding voraciously and their daily movements increase as food supplies diminish.

Turkeys have been described as forest vacuum cleaners because of their varied food habits. While meals depend on the time of year and type of habitat, turkeys primarily eat nuts, seeds, and fruit, collectively called mast. Acorns are favored in nearly all parts of the country, but turkeys also eat grasses, leaves, grapes, dogwood berries, sorghum, sumac berries, and various herbs and grains. Animal food consists of beetles, grasshoppers, crickets, and many other insects as well as crayfish, spiders, and snails. There are even records of turkeys eating salamanders.

WILD TURKEYS USUALLY have no problem surviving snowy winters, for they can scratch through several inches of snow to reach buried food. However, sleet or melting and refreezing conditions do cause problems if the birds can't break through the thick crust. When this happens they feed from trees, and when the weather is very severe, they can survive without food for a week.

Turkeys keep constant watch for predators, and as long as they do, they have little to fear, for their size and speed place them beyond the reach of most threats. They can run up to 18 miles per hour and when pressed, they can fly at least one-half mile. They can even swim.

Besides size, speed, and diverse means of locomotion, wild turkeys have another effective defense: keen eyesight. Their eyesight is so sharp it has been suggested that they can detect the movement of the hour hand on a clock. Bobcats, foxes, or coyotes can occasionally get close enough to make a meal of a turkey, but predation, except on eggs and chicks, is not considered a major factor in turkey mortality.

At night flocks of turkeys roost in trees. This deters predators that can't climb. But even climbing predators have a hard time approaching a roosting turkey, for sensory organs in the bird's legs detect movement of the branch. Great horned owls, which swoop swiftly and silently, are the only significant nighttime predators.

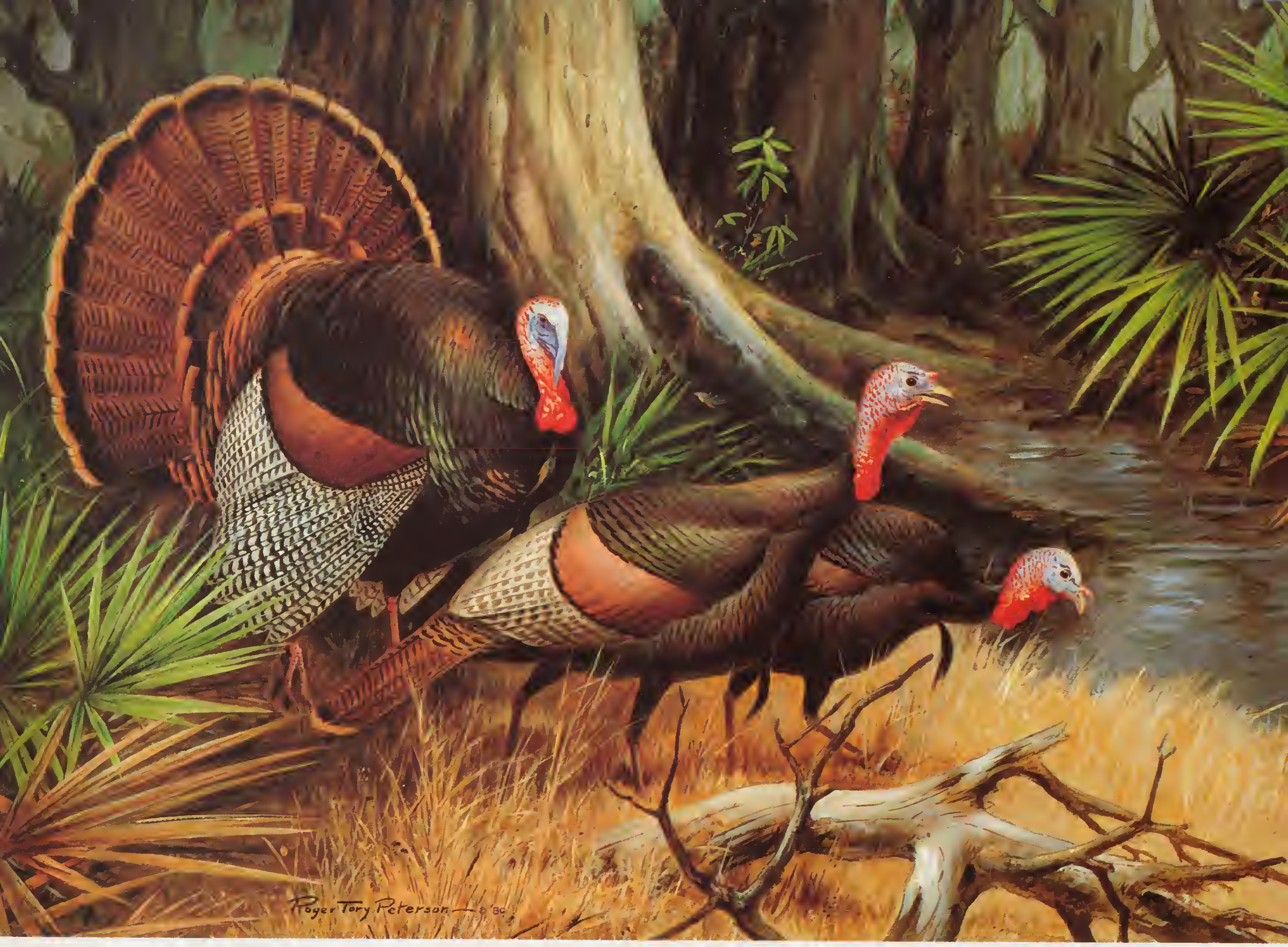
Where can you find and observe wild turkeys? You might be fortunate enough to glimpse some crossing a road or feeding in a large field. Usually, though, you have to look for them, and you must start with the proper habitat.

Turkeys are birds of the open forest. They prefer areas with occasional clearings, which supply an abundance of high-protein insects for chicks. The best habitat includes a variety of grasses, clovers, nut and fruitbearing trees; an assortment of food lessens the chance of starvation from total crop failure. Turkeys like sparse understory where they can spot approaching predators and make a quick getaway. Agricultural land is also used, especially where escape cover is nearby.

ROOST TREES ARE good places to find turkeys since flocks use them for several consecutive nights. Look for a proliferation of droppings and feathers scattered throughout a forested area.

One of the most conspicuous signs of turkeys is their scratchings seen beneath trees. The scratchings, which appear as a large "V" in the soil, are made by a turkey as it stands on one foot, reaches ahead with the other, and kicks leaves or other forest litter back and to the side. The "V," pointing in the direction the turkey is facing, forms as the bird repeats the process foot by foot.

To see the tom's thrilling courtship display, you'll need good luck or a blind and a means of imitating the hen's yelp



Courtesy of Mill Pond Press, Inc., Venice, Florida 33595

or the call of a rival tom. It's best to place your blind where turkeys have been gobbling, and you should be in the blind well before dawn. The tom begins gobbling before the sun rises and may leave the area if disturbed.

BEING IN THE PROPER habitat and knowing what to look for won't help if you're outside of the wild turkey's range. Originally, they were distributed throughout much of the eastern and southern portions of the United States, extending into Mexico. When early settlers reached America the bird was in such abundance that they could bring one home for dinner any day of the year. Flocks numbering in the thousands were reported. But, as the country developed, turkey populations suffered. Suitable habitat vanished as the land was cleared for farms and cities, and market hunting meant wholesale slaughter with little thought to the future. The bird became rare, except in portions of the southeast.

In the late 1940s, concern for the turkey resulted in the first attempts by state fish and wildlife agencies to re-establish wild turkey populations. Today, thanks to successful trap-and-transfer programs, financed largely by sales of hunting licenses and special turkey hunting permits, the birds have been re-established in pockets throughout many of their home states, including New York, Massachusetts, Ohio, Wisconsin, and Michigan. Populations also have been established in states outside the ancestral range, including North Dakota, Montana, Wyoming, and California.

LAST SPRING, at the close of an annual bird count in the Massachusetts Berkshires, my party was headed home one bird short of our goal of 90 species. The weather had been cold and rainy. Suddenly the driver stopped and silently pointed across an open orchard. There, illuminated by a tentative afternoon sun, were two huge gobblers feeding in the grass. We watched them work their way under the trees and to a fence at the orchard's edge. Moving back for a running start, they hopped the fence and disappeared into the woods.

QUIETLY WE WATCHED them go, thanking them for providing a grand finale to an otherwise miserable day. Despite the wild turkey's close encounter with extinction, sightings such as ours should again become common as the wild turkey resumes its rightful place as king of our eastern forest birds.

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THE ARTIST

Roger Tory Peterson is editor and illustrator of *The Peterson Field Guide Series.*

RESEARCH & REVIEW

by Richard E. Bonney, Jr.

A New Look at Imprinting

Have you ever seen photographs of ducklings or goslings parading after a toy train, thinking that the strange object is their mother? These odd attachments can be induced in laboratory situations by a process known as "imprinting."

Nobel laureate Konrad Lorenz, often called the father of modern ethology (the study of animal behavior), was among the first to study the phenomenon of imprinting. He discovered that the young of certain precocial birds, that is, birds that leave the nest almost immediately after hatching, have a critical period soon after they are born. During this time they "imprint" on, or form an attachment to, the first object they see. In the wild this normally would be the mother. Attachment to the mother has obvious survival value. Also, it has been assumed that imprinting is the mechanism by which birds learn to recognize other members of their own species.

Imprinting has intrigued ethologists ever since Lorenz popularized the phenomenon in 1935. Consequently, it has been studied often, and thousands of young ducks and geese have been imprinted on scientists, beach balls, and flashing bread boxes.

While the imprinting process has become understood, certain questions have been largely ignored. In particular, since imprinting studies have used artificial objects, it has not been known whether the experiments are studying the same biological processes that occur in nature. Young birds do not have to distinguish beach balls from other birds. However, they must distinguish members of their own species from those of other species, similar in form and habit, that live in the same place.

With this in mind, Timothy D. Johnston and Gilbert Gottlieb of the North Carolina Division of Mental Health devised some experiments to investigate mallard duck imprinting on "biologically relevant" objects.

Their imprinting experiments were modeled after earlier ones, but they substituted stuffed hens of various species of waterfowl for the non-biological objects traditionally used ("Development of visual species identification in ducklings: what is the role of imprinting?" *Animal Behavior,* vol. 29, pp. 1082–1099).

In the first of several experiments, Johnston and Gottlieb exposed 122 one-day-old mallard ducklings, *Anas platyrhynchos,* to an adult female model of one of three species of waterfowl: another mallard, a pintail, *Anas acuta,* or a redhead, *Aythya americana.* The models revolved around the perimeter of a test arena and emitted a mallard maternal call. The researchers expected that each duckling would imprint on the model to which it was exposed, regardless of the model's species. Then the ducklings, given a choice of following either the familiar model or a model they had never seen, should follow the familiar, or imprinted, model.

For example, a duckling trained with the mallard and then given a choice between following the mallard or the redhead should follow the mallard; a duckling trained on the redhead and then given a choice between following the mallard or the redhead should follow the redhead.

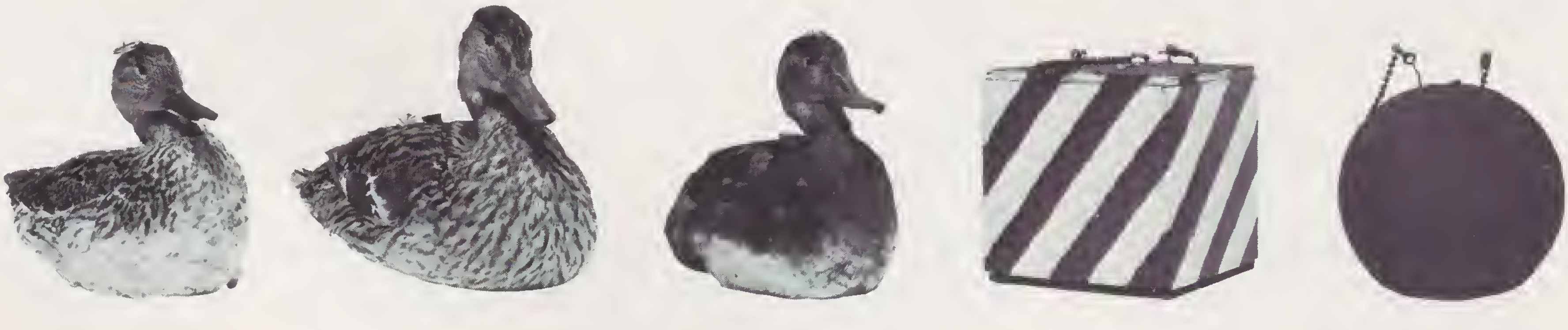
But when the researchers conducted choice tests, the results were surprising. Most of the supposedly imprinted ducklings showed no preferences! In fact, the only ducklings that behaved as expected were those trained to the mallard and then given a choice between the mallard or the pintail; these ducklings followed the familiar mallard. Thus, few of the ducklings seemed to be imprinting on the test models.

Johnston and Gottlieb wondered if their results could have been caused by ineffective experimental design. Perhaps something was lacking in the test setup; perhaps their procedures were different from those of earlier researchers. To investigate these possibilities, they tried imprinting 98 new ducklings, this time on either the mallard model or on a red striped box or a green ball, objects similar to those used in previous studies by other researchers. As in the first experiment, all the models emitted mallard maternal calls.

When the new ducklings were given choice tests, they *did* follow the familiar model—for example, ducklings trained to the ball followed the ball rather than the box; ducklings trained to the box followed the box rather than the ball. It seemed, therefore, that the ducklings imprinted on artificial objects more readily than on natural models. Why? The results do not answer this question. Johnston and Gottlieb speculate that perhaps the artificial objects are more "perceptually salient," that is, easier to distinguish between than the various duck species.

Next, Johnston and Gottlieb reconsidered the results of the first experiment, specifically, the one case in which imprinting may have occurred—i.e., those ducklings that followed the familiar mallard rather than the unfamiliar pintail. Could this, they wondered, actually be due to a "naive preference" for the mallard—a preference not developed through learning?

To test this question, they again gave choice tests, but this time to 121 new ducklings that were not exposed to any models before being tested. Some of these ducklings had a choice of approaching either the mallard or the pintail; others, the mallard or the redhead. Again, the models emitted mallard maternal calls. If these untrained ducklings did have naive preferences for the mallard, they would be expected to approach the mallard. But the ducklings showed no preferences. Instead, they approached all models with about equal frequency. This seemed to indicate that, in the



Thanks to Gilbert Gottlieb

The five models used in the imprinting experiments. From left to right: Pintail, Mallard, Redhead, Red Striped Box, Green Ball.

first experiment, the ducklings had learned the preferences shown for the mallard over the pintail. Why did they not learn a preference for the mallard over the redhead?

One possibility was that the training period was insufficient to permit the ducklings to distinguish between mallard and redhead models. So, the researchers attempted to simulate the normal experience of the ducklings by "brooding" them with a mallard model for 24 hours before the training period. Then the ducklings were given choice tests between the mallard and redhead models. Still there was no evidence of imprinting. In fact, the ducklings showed a slight preference for the redhead!

Perhaps, Johnston and Gottlieb surmise, the mallard ducklings do not distinguish between mallard and redhead models because they do not need to in the wild. Mallard ducklings may seldom encounter redheads in natural situations, since their nesting ecology is dissimilar. On the other hand, mallards and pintails often nest close together. This may explain why the ducklings do develop a preference for the mallard model over the pintail.

Johnston and Gottlieb feel that these results raise doubts that imprinting is the mechanism by which precocial birds learn to recognize members of their species. Unfortunately, the results do not explain how species recognition is developed. However, they clearly point to the need for understanding the natural situations in which birds learn to discriminate between species. Apparently, natural settings are far more complex than laboratory experiments of traditional imprinting studies.

For example, researchers who have studied duck broods in the field report that the hen's call is more important than her appearance in controlling duckling behavior. Perhaps species recognition and social attachments are developed through sound rather than sight. Lorenz himself discovered that mallard ducklings would accept him as their mother only when he quacked loud and long in his best approximation of a mother duck. Perhaps, in these experiments, the ducklings' apparent failure to imprint resulted from the fact that all the test models emitted mallard maternal calls.

Does imprinting have significance in the natural world? Or, as these results seem to suggest, is imprinting—at least in the case of mallards—an artifact of laboratory testing? Only further experimentation and observation can answer these questions. But Johnston and Gottlieb strongly suggest that researchers who investigate the imprinting phenomenon look beyond traditional studies to determine the importance of imprinting in nature. They feel that the true role of imprinting will be determined only when all of the ecological factors surrounding the nesting biology of precocial birds are understood.

Song and Reproduction

Many birds have a variety of song types. In southern England, the male great tit, *Parus major,* sings from one to eight distinct songs. Researchers at the Edward Grey Institute of Field Ornithology, Oxford, England, have been studying this bird and its songs for several years. Recently, they have related song repertoires to the tit's lifetime reproductive success (*American Naturalist,* vol. 118, pp. 149–159).

Over a six-year period, Peter McGregor, John Krebs, and Christopher Perrins recorded 152 male birds. They discovered that males singing several song types produced larger offspring, more offspring that survived to breed, and were more likely to survive and breed in a second year, than males that sang only a few song types.

Does the larger repertoire actually cause higher reproductive success? Probably the relationship is indirect. The researchers feel that a large song repertoire increases a male's success in competing for favored nesting areas, and that reproductive success is in turn influenced by high-quality habitat. What is not clear is how the repertoires develop. It is known that they are not inherited. The researchers suggest that repertoire size reflects differences in learning opportunities, with the number of songs heard at the beginning of the nesting season influencing final repertoire size.

* * *

DID YOU KNOW?

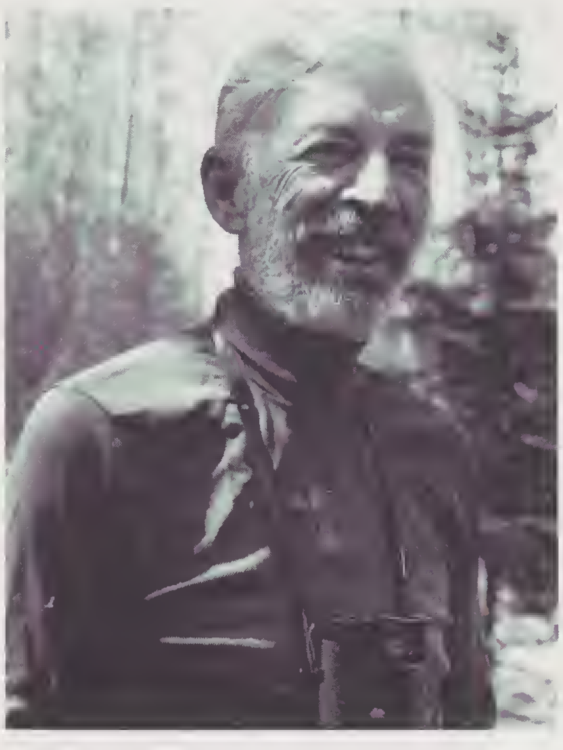
The tiniest feathered creature also has the fastest wing-beat. The hummingbird's wing-beat may be as fast as 50 to 75 times per second.

NEWS & NOTES

Sound recordist William W. H. Gunn received the 14th Arthur A. Allen Award for his contribution to popular ornithology at an award dinner in Ithaca, N. Y. earlier this month. Presenting Dr. Gunn with the medal was the first recipient of the award, Roger Tory Peterson.

Gunn has helped in the production of television and radio programs for the Canadian Broadcasting Corporation, and has published recordings of bird sounds, some with Donald J. Borror.

The Cornell Laboratory of Ornithology established the award in 1966 in memory of Arthur A. Allen, eminent ornithologist and teacher at Cornell for nearly 50 years.



William Gunn

Les Line, editor of *Audubon* magazine, has become consulting editor of *The Living Bird Quarterly.*

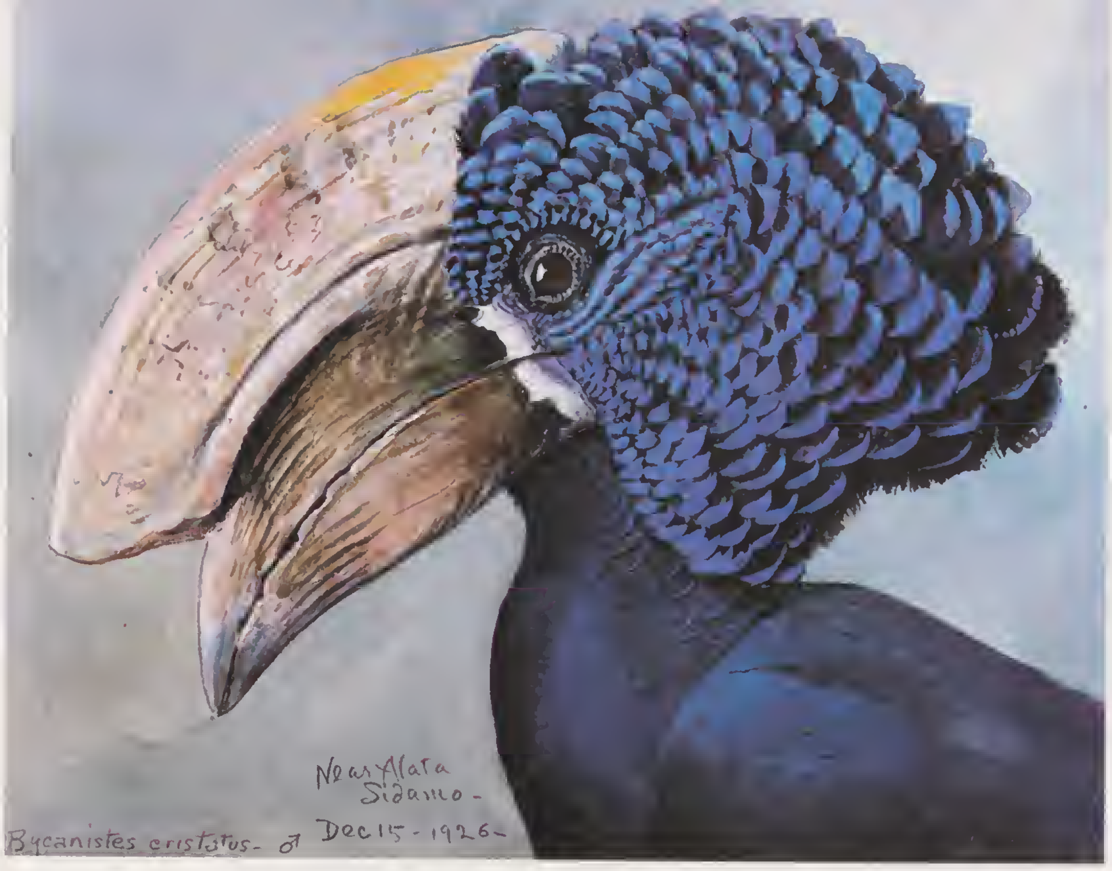
The Laboratory has a new development officer, Samuel A. Eliot. Prior to his appointment, Dr. Eliot held the position of vice president of the College of the Atlantic, Bar Harbor, Maine. He was also a founder of that college.

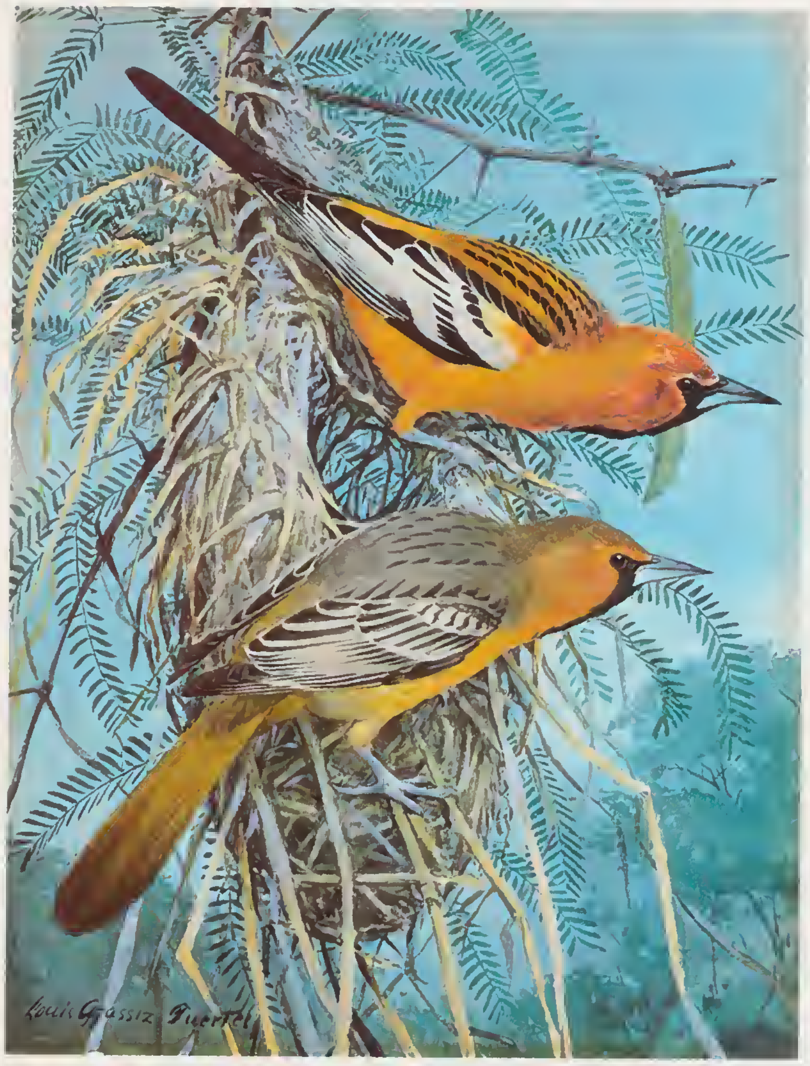
Gift certificates from *The Crow's Nest Bookshop* are now available for everyone on your holiday gift list. *The Living Bird Quarterly,* too, would make an excellent present.

Peregrines' Progress: the magnificent falcon, rescued from extinction east of the Mississippi by the Peregrine Fund, continues to do well in the wild. Over 200 young were produced in captivity this season and all but about a dozen were released. Read more about the peregrines in *The Peregrine Fund Newsletter* and in the next issue of *The Living Bird Quarterly.*

A photographic safari to East Africa is being sponsored by the Laboratory in February, 1983. The focus will be on the remarkable birdlife of Kenya's Great Rift Valley. For further information write to Photo Safari, Laboratory of Ornithology.

Finally, a comprehensive study of the art of Louis Agassiz Fuertes . . .





Above: Streak-backed Orioles
Right: Silvery-cheeked Hornbill

A Celebration of Birds
The Life and Art of Louis Agassiz Fuertes

Robert McCracken Peck
Introduction by Roger Tory Peterson

A Celebration of Birds examines the essence of Fuertes's genius and assesses his enormous influence in the worlds of art and ornithology.

The book, with 49 full-color plates and over 100 black-and-white illustrations, dramatically demonstrates why he is acclaimed as unsurpassed in his ability to capture the grace and beauty of birds.

Robert McCracken Peck, art historian and naturalist, has written for *Audubon* magazine, *Arts Magazine, American Art Review,* and other popular and scholarly publications.

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Celebration accompanies a major exhibit of Fuertes's work, opening this month in Philadelphia and prepared under the auspices of the Academy of Natural Sciences.

THE ACADEMY OF NATURAL SCIENCES
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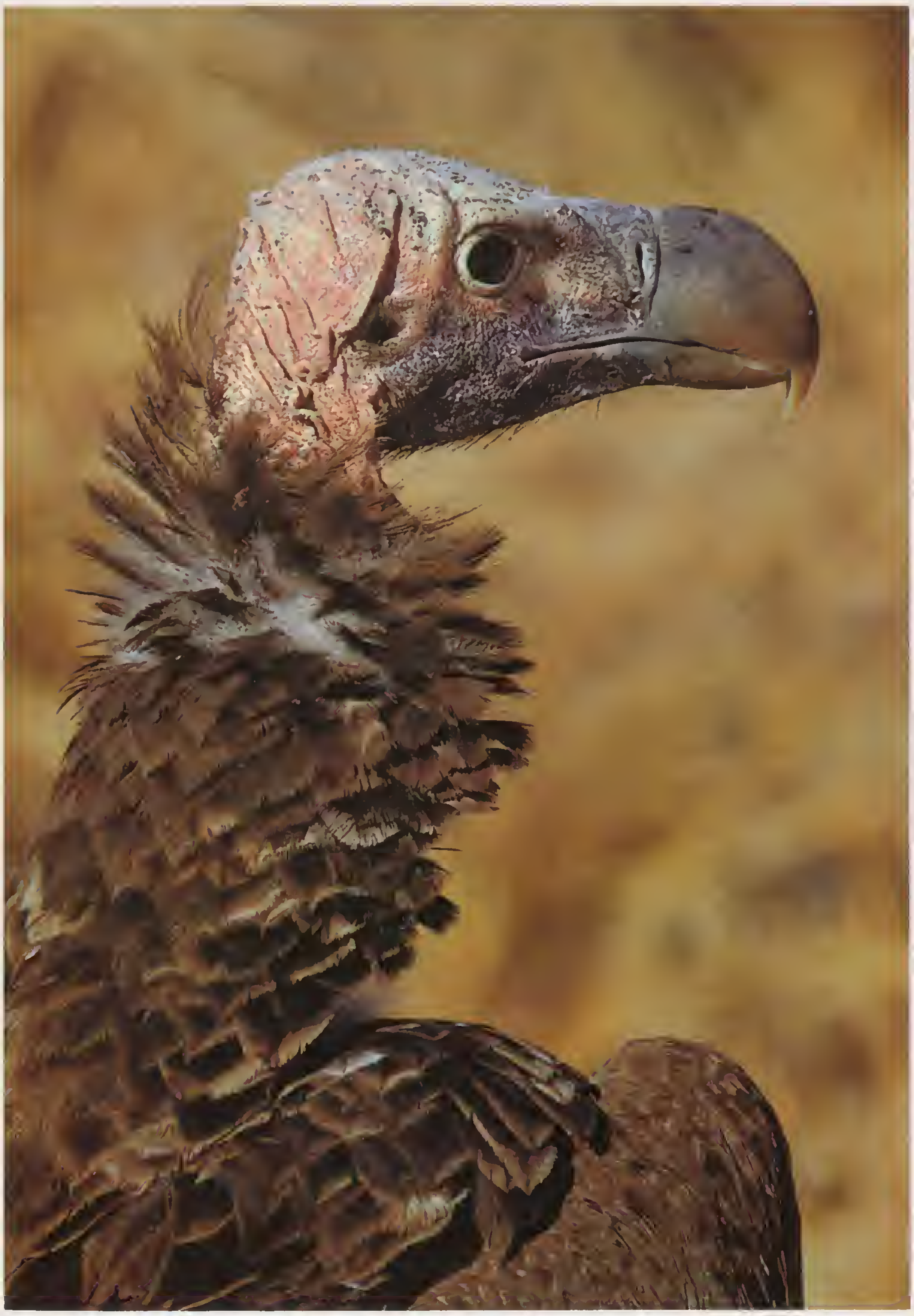
With a Little Bit of Luck

article and photographs by **George H. Harrison**



Lappet-faced vulture in Zambia.

HAVING PHOTOGRAPHED birds for nearly 40 years, starting at age seven, I was perplexed by the question put to me by the *Quarterly*'s editors, "What are your most outstanding bird photographs?"

What did they mean by outstanding? Is the outstanding quality of a bird photograph determined by the difficulty endured to obtain it? By the rarity of the species? By the artistic quality it exemplifies? Or by the number of times it has been published? My selection of these photos was based on all of those elements, as well as that elusive phantom, luck.

Luck was the overriding influence in the cardinal photo made through the living room window at our home in Wisconsin. I had set up to photograph birds on a feeder when the cardinal posed, in the wind, a foot from the feeder. By moving the camera blindly in the bird's direction and shooting, without any real confidence that I would get anything, I got it. The same can be said for the lappet-faced vulture photographed in Zambia. Had the bird not eaten so much carrion elephant meat, it would have been able to fly away. As it was, the poor bird couldn't even walk. I shot that photo with a 135mm lens.

Difficulty and rarity as well as luck played parts in the Cuban pygmy owl photo made at the Bay of Pigs a few years ago. It was sheer luck to spot this rare red phase of the owl sitting about 12 feet above the ground, preening itself after having finished some mammalian morsel. The difficulty came in getting into the Bay of Pigs to photograph

Harrison photographed this catbird in a neighbor's hedge nearly 40 years ago.

Above: *Rare Siberian cranes on their wintering grounds, Bharatpur Bird Sanctuary, India.*

Right: *Cardinal in the wind: a lucky shot.*

the owl. My wife, Kit, and I had been invited there by the Cuban government to advise them on arranging American bird watching trips, but much delicate negotiating preceded our visit.

Difficulty and beauty played major roles in the photo of the mute swan, shot on the bird's native breeding grounds at the Astrakhan Wildlife Preserve at the mouth of the Volga River in the Soviet Union. The first American ever to visit the preserve, I had to be poled in a flatbottomed boat across the shallow marsh by two Russian wildlife biologists until we were close enough to get this shot with my 400mm lens. I am still the only American journalist who has gone to the Soviet Union under the terms of the Joint Agreement on Conservation and Environment (détente).

The photo of the Siberian cranes required 13 hours of sitting on a table top inside a reed blind in the middle of a marsh at the Bharatpur Bird Sanctuary in India. Although I had entered the blind before daybreak and had all the photos I needed within an hour, I remained in the blind until after dark in order not to disturb the world's only known flock of wintering Siberians.

A good memory, dating back 30 years, helped me to obtain the bluebird photo. I remembered helping my father photograph bluebirds at my grandfather's farm in western Pennsylvania when I was a boy. Needing photographs of bluebirds myself recently, I returned to that same farm and was delighted to find progeny still thriving there. It was then simply a matter of setting up a blind near the nesting box to get the photo.

One advantage I have as a bird photographer is having a great teacher. My father is Hal H. Harrison, author of two field guides to birds' nests. He was one of the pioneers in the field of nature photography, specializing in birds. At age 76, he is still very active, and is currently putting the finishing touches on his life's work, a book on the wood warblers of North America.

Since the days when Dad helped me with my first setup on a catbird's nest in a neighbor's hedge, photographic equipment has come a long way. In fact, it has been improved to the point where anyone with the desire, patience, and some knowledge of the subject can take excellent bird photographs. Today, camera equipment is much more reliable, portable, easier to obtain and to operate than it was 40 years ago. Most important, today's equipment produces far better results.

To get all of these photographs I used one of two kinds of cameras and several lenses. Some were made with Leicaflex cameras while more recent takes were made with Olympus OM2 cameras. Regardless, nearly all were shot through the Leica 400mm lens which I have had adapted for use on both cameras. I believe it is the finest piece of glass ever made for any camera.

The OM2's are equipped with automatic winders which allow the use of a remote-control wire with a push button. The automatic metering system in the OM2, the winder, and remote control, allow me to shoot a 36-exposure roll of film without getting out of my blind or otherwise disturbing the subject. This is a far cry from the 4x5 Speed Graphic, sheet film, blue bulbs, and homemade dry cell battery remote control system I borrowed from my dad for the catbird shot.

One thing has not changed, however, and that is the need to use a tripod whenever possible. Though my 400mm Leica lens comes equipped with a shoulder brace, it is far better to use it from a sturdy tripod, and with a cable release. That way the camera cannot move and photographs should be sharp. The tripod also permits me to slow down the shutter speed and thus "stop down" the aperture, giving me more depth of field, and a still sharper photograph.

Film is very important when shooting for magazine reproduction. Most leading color magazines now insist on Kodachrome. That means only 35mm and ASA speeds of 25 and 64. The reason for this is that Kodachrome has virtually no grain in the composition of the film, thereby permitting enlarge-

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ment of a small part of a Kodachrome transparency with little or no deterioration of the image. Ektachrome and other color films have noticeable grain patterns which make the enlarging of a photo to page size more difficult without loss of quality.

The importance of this sort of technical information depends upon what the photographer intends to do with his or her bird pictures. If they are taken merely for fun, then it doesn't really matter what kind of film or camera is used. For amateur photographers, today's films and cameras are all of the highest quality and good bird photographs can now be made with the simplest of equipment, Instamatics included. Kit and I have juried the *National Wildlife* magazine photo contest every year since its inception and are amazed at the high-quality photography coming from the simplest equipment.

One important fact that I have learned after painful experiences in bird blinds is that many fine bird photographs can be made from the comfort of one's own living room. A few years ago we built an addition to our home in which large thermopane windows were installed close to our bird feeding station. The quality of the glass is so good that I can shoot photographs through it without any apparent loss of quality, even at severe angles. This luxury allows me to set up my equipment and leave it in the living room until the light and other conditions are perfect. No more long periods of waiting in blinds, in cramped conditions, in all kinds of weather to get photos of backyard birds. I simply wait until everything is right while I work on other projects. The cardinal photograph is an example of through-the-glass photography.

The essential point to remember, however, is to enjoy taking pictures. Bird photography can be much fun, though very challenging at times. Birds are among the most visible and fascinating of all wild creatures. Photographing them in their natural habitat can be one of the most rewarding experiences one can have in the outdoors. A little luck doesn't hurt either.

FURTHER READING

Harrison, George H. *The Backyard Bird Watcher.* Simon and Schuster, New York. 1979.

THE AUTHOR

George H. Harrison is field editor of *National Wildlife* magazine and a contributor to the Laboratory of Ornithology's *Home Study Course in Bird Photography.*

Above: *Cuban pygmy owl in rare red phase.*

Right: *Harrison returned to his family's farm in western Pennsylvania after 30 years to find the bluebirds still nesting there.*

Below: *Harrison photographed this mute swan in its native habitat at Astrakhan Wildlife Preserve in the Soviet Union.*

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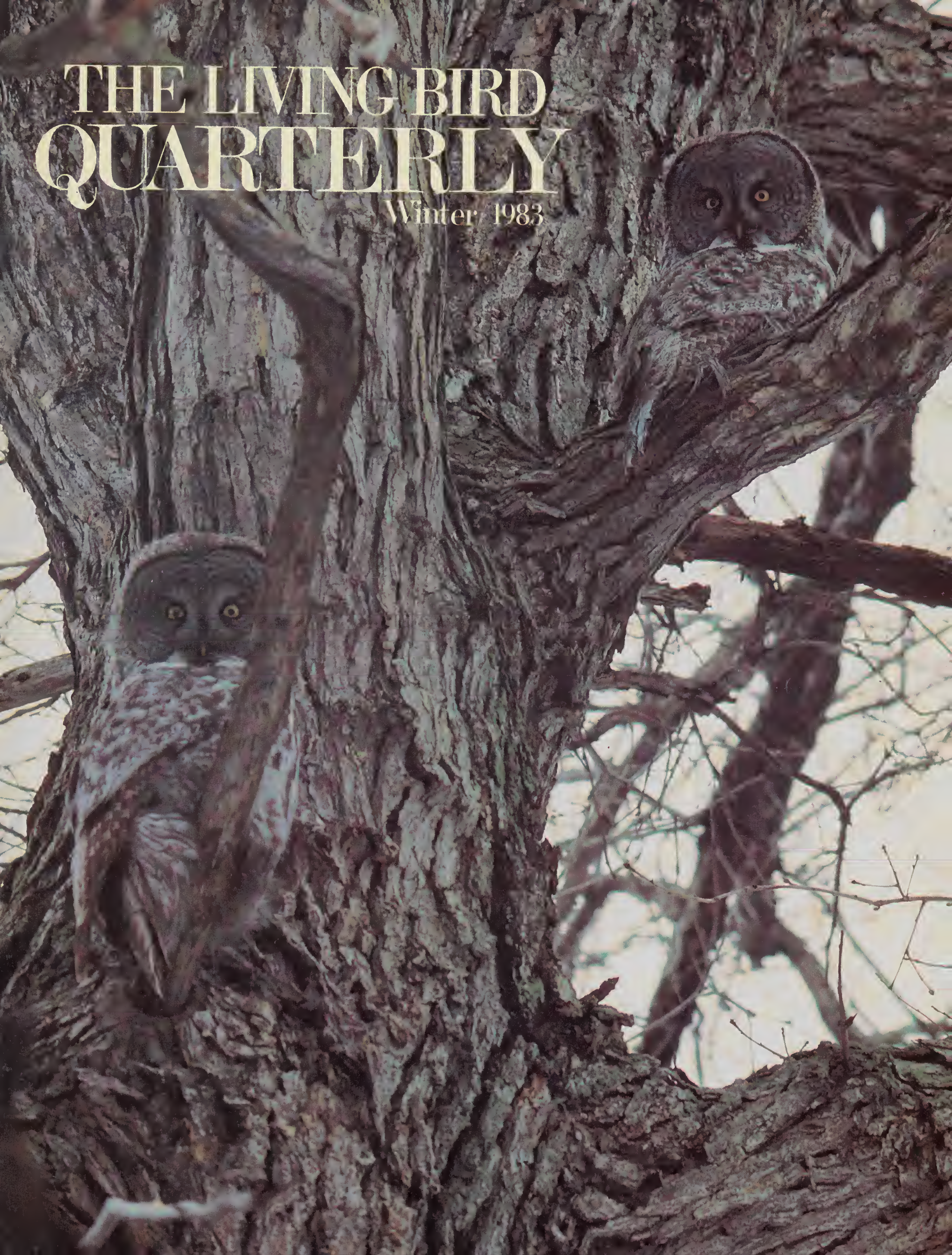
THE LIVING BIRD QUARTERLY

Winter 1983



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Least bittern. Photograph by Gary Meszaros.

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Winter/1983
Volume 2 Number 1

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FRONT COVER. Great gray owls, Amherst Island, Lake Ontario. Photograph by Gary Meszaros.

BACK COVER. Burrowing owl. Photograph by Paul H. Rosenfeld.

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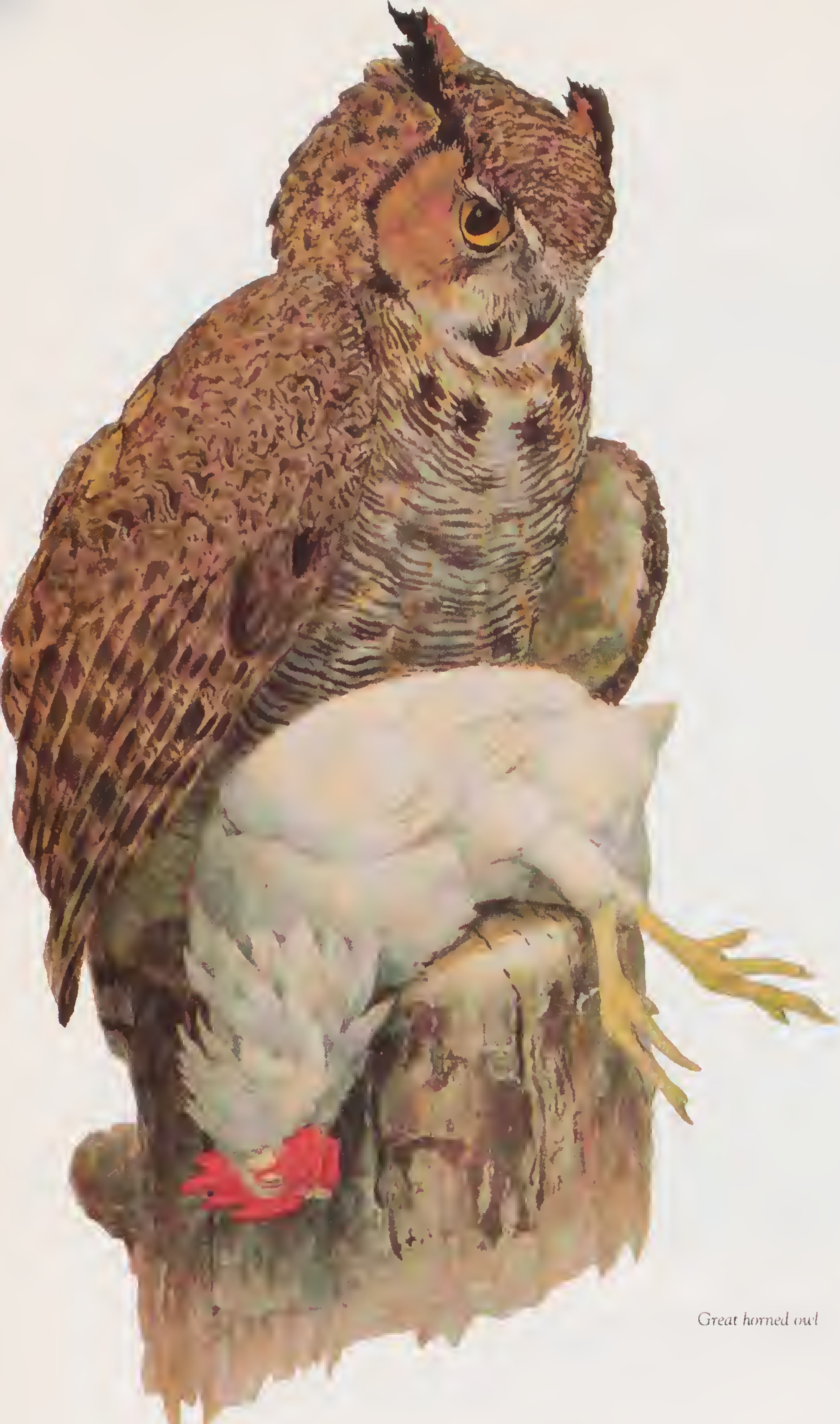


Great horned owl

From Persecution

article by **Walter R. Spofford**

MAN HAS ALWAYS had strong feelings toward birds of prey. In primitive cultures they were seen as the epitome of strength, power, and courage to be worshiped and feared. American Indians admired predators for their skill and cunning in capturing prey and worshiped them in the hopes of gaining those qualities for themselves.

Early European settlers in America found themselves in a wild and foreboding land. Survival depended on conquering the wilderness. Although some settlers adopted the Indians' admiration for predators, the more common feelings were fear and hatred. Legends about predators became part of American folklore, and ignorance of their role in nature was widespread and profound.

The summit of this ignorance could be found during the late 19th century along the crest of eastern Pennsylvania's Kittatinny Ridge. There, men armed with shotguns waited for the annual fall migration of hawks and destroyed any hawk that crossed their gunsight. It was not uncommon for thousands of birds to be shot in a given season.

But, at the same time, attempts to counter the slaughter and to preserve our natural heritage were being realized, and a growing campaign to protect and conserve wildlife was taking root. By 1932, the world's first sanctuary for the protection of migrating birds of prey was born on the very site of earlier hawk massacres. By the end of that decade a few gunners still crept to the edge of Hawk Mountain to take a shot at a passing Cooper's hawk, but more and more people were stopping simply to watch the spectacular autumn flights.

Around this time, too, studies of raptor populations were beginning. Scientists were looking for basic information with no thought of the usefulness of the results. They were not aware that the birds they were studying would soon face unexpected and drastic reductions in their populations.

Peregrine Tragedy. Joseph J. Hickey was conducting intensive research on peregrine falcons nesting in New York City and a more general study of their populations east of the Rocky Mountains. Hickey's studies were not only extensive geographically, they reached backward in time; his center was near the American Museum of Natural History, so few records escaped his appraisal. With the exception of some eyries lost to city encroachment, he found the eastern peregrine population to be relatively stable. There was a slow decline over the decades, but populations had withstood the onslaught of egg collectors and predators for a century. Most eyries were active each year, many fledging two to four young.

Real discovery that the peregrine was in trouble came in 1961 when an investigation by Derek Ratcliffe in Great Britain found that many English eyries were abandoned, and the active nests had fewer eggs and fledged fewer young. A decade earlier Ratcliffe had found broken eggs at one eyrie and at another the female was eating her own egg. Later he showed that the broken eggs had thinner shells than unbroken ones, and a multitude of research projects soon established that DDT, first released in 1946, was the cause of eggshell thinning. By weighing museum-collected sets of peregrine eggs, Ratcliffe found that a major change had taken place in 1947; after that date, most eggshells were 20 percent lighter and so thin they broke while under incubation.

Hickey found the same story with peregrine eggs in this country, and soon pesticides were appreciated as the causative agent in the widespread American population declines. Indeed, the whole eastern population of the peregrine was extirpated. The last nesting of this subspecies occurred in the late 1950s, and by 1964, no bird was found at any eyrie in the eastern United States. The peregrine had disappeared before anyone realized.

Bald Eagle Debacle. It was 1939 when Charles Broley, then 60 years old and newly retired from a banking career in Canada, stood in western Florida gazing up the huge trunk of his first "eagle tree." In his pocket were four eagle bands; Richard Pough had assured him of a few more should he need them. Eight years and 814 banded eaglets later, Broley pub-

to Propagation

paintings by **Louis Agassiz Fuertes**

lished the results of his study of Florida eagles in *The Wilson Bulletin.* It is hard to overestimate his contribution to our knowledge of the bald eagle. His study included 140 nests, with detailed summaries of 49. During this period, Broley worked with the west Florida eagle populations each winter, climbing over 1,000 trees. The rest of each year he studied and banded eagles in Ontario and the eastern United States.

His findings were astonishing. The eagles nested in Florida during winter, but, as his band recoveries showed, the young moved north after fledging, soon arriving in Canada—from New Brunswick and Prince Edward Island all the way to Lake Winnipeg! Few adult eagles remained in Florida during the summer, and Broley suggested that the September flight of bald eagles at Hawk Mountain was of Florida birds returning south to nest. That southern Canada eagle populations included Florida eagles was an arresting discovery and required some re-thinking of subspecies boundaries and definitions.

Perhaps Broley's most important finding was the high nesting success of the Florida eagles. Of the 49 nests summarized in his 1947 paper, most fledged two young, some of them year after year. One nest fledged 19 young during the eight-year study.

Then the bottom fell out. By 1950, the number of active, successful nests had dropped alarmingly and Broley entitled an article in *Audubon* magazine, "The Plight of the Florida Bald Eagle." Like the peregrine, the bald eagle's problem was eggshell thinning resulting from chemical contamination of the birds' food supply.

Different populations were variously hit by the contamination. Curiously, three pairs in northwestern Pennsylvania managed to carry on throughout the years while the nearby New York State population disappeared, except for one "hang-on" pair. By comparison, 25 years ago pairs were nesting at Montezuma National Wildlife Refuge at the head of Cayuga Lake in central New York.

Condor Catastrophe. When Karl Koford began his condor study in 1939, there was much less known about America's largest raptor than of the peregrine and the bald eagle. For two years Koford spent his time in remote canyons and mountains in the condor range and, after the war, he returned for more field study until his monograph was published in 1953.

He accumulated more than 3,500 pages of field notes and his observations were so extensive and varied they defy summary. But he did conclude that the population was relatively stable and comprised 60 birds. That population size, even of so few birds, did not cause great alarm.

Whatever changes took place in the condor population occurred so slowly and inconspicuously that they were hard to detect. But, as Koford pointed out in his appraisal of the population, the exceedingly slow breeding with such restricted breeding potential indicated that the failure of a single nest could alter the future of the entire population.

Ten years after Koford's study things had changed drastically. Ian and Eben McMillan, ecology-minded ranchers who had watched California condors for nearly 50 years, found only 40 birds. Ian McMillan noted that careless or deliberate shooting of as few as one bird a year would severely affect the population. By the 1970s this, combined with agricultural poisoning, habitat alteration, eggshell thinning, and the condors' inability to cope with human disturbances, had brought the population down to about 30 birds.

Recovery. The efforts of Tom Cade, Stanley Temple, Peter Nye, and Michael Allen are firsts in raptor management. In a sense, it was our failure to monitor hawk populations that allowed drastic die-offs before we even became aware of the problem. Charles Broley noticed a decline in bald eagles, and right when it began in the late 1940s. But having to resort to captive breeding was unthought of.

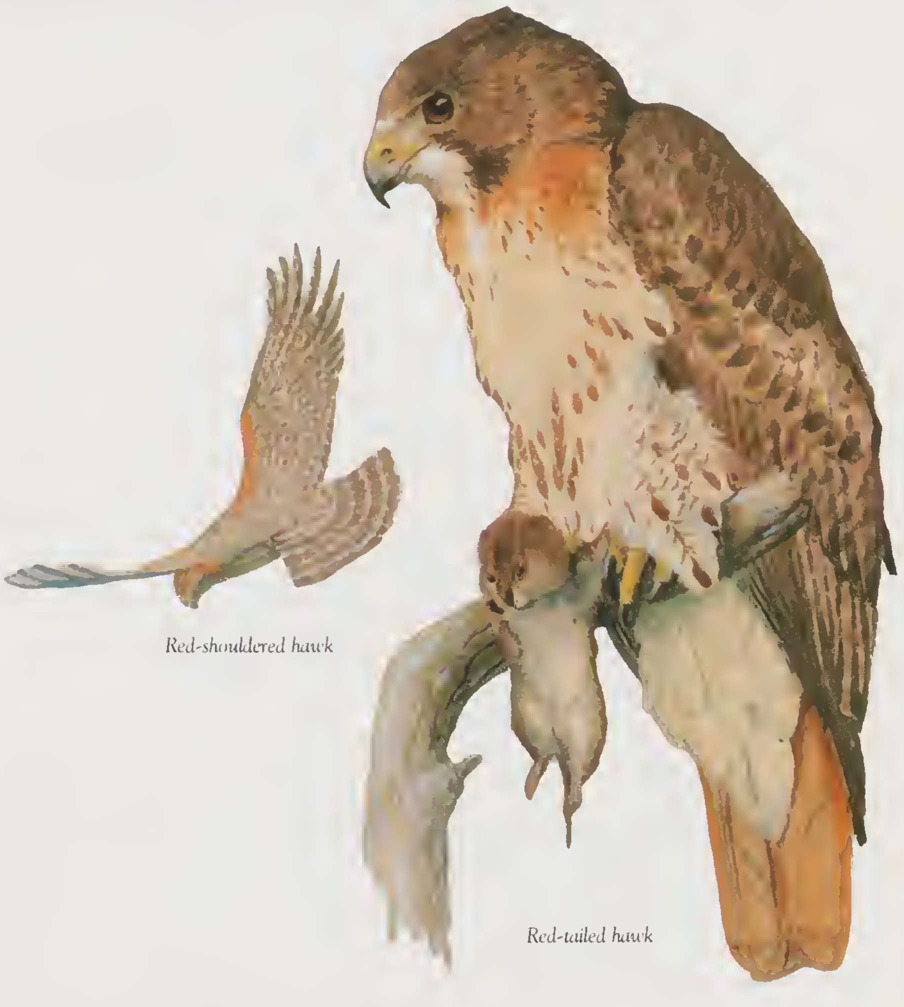
The success of these projects has come about only after countless hours of laboratory and field work, and the field work in particular has called for devoted and continuous work in difficult conditions in remote locations by enthusiastic raptorphiles. Such a dedicated group was unheard of a few decades ago.

While raptor management has become a necessary tool, it is not a cure. Today we are watching raptor populations and we know that some are still declining despite reduced environmental levels of DDT. Other chemicals, some more toxic, have taken its place and destruction of raptor habitat continues unabated. The ultimate conservation of raptor populations — indeed of all predators — will depend on the preservation of wildlife habitat and on the wise and discriminate use of chemicals in forestry and agriculture.

THE AUTHOR AND ARTIST

Walter Spofford, now retired, taught neuro-anatomy at Upstate Medical Center, SUNY, Syracuse, New York. His major life interest has been the study of birds of prey.

Louis Agassiz Fuertes (1874—1927) reached national prominence for his sensitive and realistic portrayal of birds. Art on loan from David G. Allen.



Red-shouldered hawk

Red-tailed hawk

Renaissance of the Peregrine Falcon

by **Tom J. Cade**

> *"The peregrine falcon is, perhaps, the most highly specialized and superlatively well developed flying organism on our planet today, combining the highest powers of speed and aerial adroitness with massive, warlike strength. A powerful, wild, majestic, independent bird, living on the choicest of clean, carnal food, plucked fresh from the air or the surface of the waters, rearing its young in the nooks of dangerous mountain cliffs, claiming all the atmosphere as its domain and fearing neither beast that walks nor bird that flies. It has its legitimate and important place in the great scheme of things, and by its extinction, if that should ever come, the whole world would be impoverished and dulled."*

In 1904, G. H. Thayer described the peregrine falcon with these poetic words in *Bird-Lore,* forerunner of *Audubon* magazine. He was not the first to marvel at the aerobatics and noble bearing of this bird. For centuries naturalists, bird watchers, and falconers have extolled the peregrine because of its consummate skill in the air, swooping for prey at speeds of 200 miles per hour.

It is curious that at the turn of the century Thayer should have expressed concern about the extinction of the peregrine. Although sparse in number compared to many other raptors, the peregrine enjoyed the widest natural distribution of any bird, nesting on all continents except Antarctica. Also, its breeding populations had been constant for centuries. Such a species was not a likely candidate for extinction.

It came as a distinct surprise some 50 years after Thayer's remarks when biologists discovered that peregrine populations were suddenly and mysteriously disappearing in many parts of the world. Another 10 years passed before researchers proved that persistent pesticides such as DDT were responsible for the losses.

The peregrines were contaminated by feeding on small birds—jays, swallows, pigeons—that had themselves fed upon poisoned insects. Even after the use of DDT was greatly restricted in this country in 1972 and the concentration of the pesticide decreased, the effects on peregrines continued. Female falcons were unable to assimilate calcium properly for construction of eggshells. The thinner shells were easily crushed under the weight of an incubating bird.

In the 1930s and 40s, before the DDT debacle, around 350 pairs of peregrines bred from the Mississippi River to the Atlantic coast. By the 1960s no pairs were known to be nesting anywhere east of the Mississippi. In 1969, the peregrine falcon was officially listed as an endangered species in the United States.

Responding to public concern, we at the Laboratory of Ornithology and the Division of Biological Sciences at Cornell University began a program to develop methods of raising peregrines in captivity and later releasing them into areas where they had disappeared. At the same time we started The Peregrine Fund for receiving contributions in support of the work.

In 1974, The Peregrine Fund began a second breeding program in cooperation with the Colorado Division of Wildlife at Fort Collins. Its purpose was

Below: *Researcher Jim Weaver with young peregrine at eyrie, Royal Gorge, Colo.*

Right: *Eyrie, northern coast range, Calif.*

Courtesy of The Peregrine Fund

Tupper Ansel Blake

J. Sherwood Chalmers

Left: *Caretaker Michele Barclay feeds chicks hatched at Cornell hawk barn. As yet they are too young to associate humans with food.*

Right: *Tom Cade feeds imprinted male.*

to increase the density and extend the geographic distribution of the greatly reduced nesting population of peregrines in the Rocky Mountains and adjacent western regions. Since 1977 a third operation, organized by the Santa Cruz Predatory Bird Research Group, has been under way, with the same objective in California and the rest of the west coast. It has recently joined The Peregrine Fund, giving us three recovery programs.

These breeding facilities, modeled after the 40-chamber "hawk barn" in Ithaca, New York, were designed to allow captive pairs of falcons to mate undisturbed while being monitored by researchers. From long, dark corridors outside each compartment, workers watch the falcons through one-way windows. Falconers donated some of the first birds we used as breeding stock; others were taken as nestlings from remnant populations. Some people were skeptical about whether we could breed peregrines in captivity, saying they were too wild. We realized, though, that drastic measures were necessary if we were ever again to see wild peregrines east of the Mississippi.

Our first task was to increase the number of young produced by each of our captive pairs. We experimented with a technique known as double clutching. A female peregrine normally lays a clutch of four eggs. To encourage her to lay more, we remove the clutch and place it in an incubator. Sixteen days later, the females lay a second set of eggs and sometimes even a third.

After they are made fertile, either through mating or artificial insemination, the eggs are placed in an incubator where they are kept at the proper temperature and humidity. About a month after that, the chick inside begins to chip away at the shell. Fifty to 60 hours later, it is finally free. Within a few hours the down has dried, and a fluffy white chick is begging for food. Human caretakers feed ground quail or chicken to the newly hatched peregrine for its first 10 days, then the parents take over.

In addition to barn-produced eggs, we collected eggs from the very few eyries that still exist in the west. We substituted plastic eggs for the thin-shelled natural ones and brought them to the breeding station where their chance of successful incubation is far greater. When the chicks hatch they are returned to their parents who suddenly find plastic eggs replaced by hungry chicks. No matter. The parental response is strong, and the adults soon are hunting for their brood's meal.

By 1973, 20 young peregrines had been produced in the hawk barn, a clear indication that the raptor could be bred in captivity. Each breeding season the number of young increased. By 1975, we had produced enough falcons in our Cornell facility to take the next step — to release the young peregrines into the wild. This we did with a process borrowed from falconry known as hacking.

In hacking, we put the month old falcons in a nest box, and place it on a mountain cliff, a man-made platform in a natural setting, or a city where the tall buildings provide shelter and the pigeons provide food. The young birds in the hackbox receive daily rations from human caretakers, but in a way that prevents the birds from associating food with humans. Meanwhile, the confined birds have time to look over the terrain. Once they are large enough to try their wings, the box is opened. While they are learning to fly, the young are sustained on delivered food, but as soon as they can hunt and kill, the deliveries stop. They are then on their own.

Hacked peregrines meet death in diverse and sometimes bizarre ways. In wilderness settings the great horned owl is the single most important factor, accounting for about 50 percent of all losses. In cities the young fall into chimneys and air vents, fly into plate glass windows, or get electrocuted on wires. Recently, we learned that a peregrine flew into the glass front of a gambling casino in Atlantic City.

One peregrine that has managed to escape the hazards of city living is Scarlett. She has been residing on the window ledge outside the 33rd floor of the U. S. Fidelity & Guaranty Insurance Company in Baltimore since 1978. Scarlett hatched in the Cornell hawk barn and was hacked on Carroll Island, 30 miles from Baltimore.

Since 1980, we have been trying to find a compatible male for Scarlett so that she can start producing, but things have not worked out. Two males, Blue Meanie and Misha, flew away and a third, Rhett, died of strychnine poisoning after eating a contaminated pigeon.

We do have hopes for Ashley, Scarlett's latest suitor. He was two years old during the last breeding season and not ready to mate. However, when we released him in Baltimore, he stayed in the area. Slowly he approached Scarlett's ledge and then the nest itself. Scarlett was aggressive toward him at first, but he held his ground. If he survives the winter, we think they will mate in spring. Meanwhile, Scarlett has been laying infertile eggs which we replace with barn-hatched chicks that she willingly raises.

Unlike the situation east of the Mississippi, about 20 percent of the wild peregrine population still nests in the Rocky Mountains, although breeding pairs continue to experience reproductive problems from high DDT residues in prey and their own bodies.

Here the strategy for augmenting low productivity is not unlike the one we use with Scarlett: we add captive-raised young to the nests of wild pairs, some situated at abandoned historical eyries, others at new locations. Since 1974, our workers at the Fort Collins facility have released 334 peregrines. More than 74 percent fledged successfully and dispersed. Productivity at the remaining active eyries in Colorado has dramatically increased during the past five years. We feel we have recruited a significant number of new breeders and have prevented further decline in the breeding population in Colorado.

J. Sherwood Chalmers

Most of the recovery work on the Pacific coast has taken place in California where there are only 40 to 50 eyries. In 1977, The Peregrine Fund, working with the Santa Cruz Predatory Bird Research Group, fostered the first two captive-produced peregrines at Morro Rock near Santa Barbara. By the end of the 1981 season, 27 nestlings had been successfully fostered or hacked, accounting for most of the young in the region. In 1982, a minor population explosion occurred, with 10 pairs back at historical sites.

When we began our work in 1970, most people said it was impossible to produce large numbers of peregrines in captivity. The three facilities of The Peregrine Fund now raise more than 200 young a year and, together with our Canadian colleagues and private breeders, we have introduced over 1,000 peregrine falcons to North America since 1975.

Some of our released birds are now nesting and raising their own young in the wild. It is just a matter of time before human manipulation will no longer be needed, and the peregrine will have returned to the United States from the brink of extinction.

Universitätsbibliothek Heidelberg. Codex Manessa. Zürich, early 14th century.

FALCONERS' TERMS

The medieval art of falconry has a vocabulary all its own. Although most of the terms have become obsolete, a few are still used by scientists today. Here are some of them.

- Aerie, Eyrie—The nest or nesting ledge of any of the raptors.
- Brancher—A young hawk which has left the nest or eyrie, but has not yet left the immediate vicinity.
- Casting—The indigestible portions of the last meal of a raptorial bird, usually bones and feathers that are formed into a compact pellet and disgorged through the mouth.
- Eyass, Eyas, or Eyess—A trained raptor of any age or species that was originally obtained as a nestling. Also applied to the young of raptors while they are still in the nest.
- Hack—A place out of doors where a young hawk is fed and is allowed liberty.
- Rouse—An action common to all birds in which all the feathers are slowly erected, the bird shakes itself, and the feathers then slowly settle back into place.
- Stoop—The head-first dive of a falcon from a height.

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THE AUTHOR

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More Than Just a Pretty Face

by Richard E. Bonney, Jr.

MOST OWLS ARE drab, secretive creatures that are active while bird watchers are asleep. Yet even a brief look at these nocturnal birds of prey reveals fascinating adaptations that enable them to fulfill their ecological role as night-flying mousetraps.

Some of their adaptations are shared with diurnal birds of prey — hawks, eagles, ospreys, and falcons. These include large feet with long, sharp talons for killing and grasping prey, and large, strong hooked beaks for tearing prey into manageable pieces. But unlike hawks, owls have evolved to hunt in the dark.

For instance, they have highly developed eyes. While a hawk's eyesight is indisputably superb, an owl's is downright amazing. It has been demonstrated that some owls can see at light intensities equivalent to one ordinary candle placed nearly 1,000 feet away. Such remarkable eyesight is possible because of the large size of the eyes, a large concentration of light-sensitive cells, and pupils that can open very wide. The pupils can be closed to a pinpoint so that owls can see well during the day.

The owl's extraordinary vision is supplemented by extremely keen hearing. The facial disk that encircles the eyes and beak channels sound toward the huge ear openings which, by the way, are not the ear tufts conspicuous on some owls. In addition, some owls have asymmetrically placed ears. This helps them to locate the origin of a sound by triangulation, the same method a dog uses when it cocks its head to listen. Experiments have shown that owls can hunt by sound alone; this may explain why hunting success improves in dry weather when prey can be heard rustling leaves.

Finally, these eyes and ears are attached to a creature that can fly nearly silently. The owl's flight feathers have downy edges, eliminating the whirring sound caused by the stiff flight feathers characteristic of most other birds. A flying owl can hear its prey, but, prey can't hear the owl.

Other owl characteristics are related to life in the dark. The owl's head is large, wide and rounded to accommodate the huge eyes. Drab plumage lets the bird blend into its surroundings during the day while it roosts. Courtship activities are normally less than spectacular since elaborate visual displays are of little value at night. Most owls rely upon vocalizations to initiate courtship and to mark territory boundaries.

There are exceptions to every generalization and among owls, the short-eared owl is something of an anomaly. It is the only diurnal owl commonly found south of the arctic, and is hawk-like in appearance and behavior. When perched, often on the ground, this owl leans forward in the manner of a hawk. In flight, the wings appear long, narrow, and pointed, not broad and rounded like the wings of most owls. It frequently hunts over open country and, in fact, from a distance it may be more easily confused with a northern harrier than with any other owl.

The short-eared owl is a quiet bird except during its breeding season when, high above a meadow, marsh or field, the male engages in a spectacular courtship display of "wing clapping." While diving toward the ground he rapidly brings his wings together below his body, creating a fluttering sound. While flying, he emits a long, rapidly repeated series of toots that seem to come from everywhere at once.

The short-eared owl is one of the few owls that nests on the ground. Often the nest is merely a scooped-out depression lined with fine grasses and a few feathers, but it may be built up with heavy grasses, weed stalks, or sticks.

Most owls are sedentary and solitary outside of the breeding season. In contrast, short-eared owls have a regular migration involving many individuals and, as they move south, they may congregate in areas of high prey density. Groups of 100 or more have been observed at a single roost site.

Short-eared owlets

Art Wolfe

Short-eared owl Gary Maszaros

Ron Austing

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THE SCREECH OWL really is misnamed. A better name would be whistling owl since this more accurately describes the owl's quavering, tremulous call, a series of hollow notes running into a tremolo.

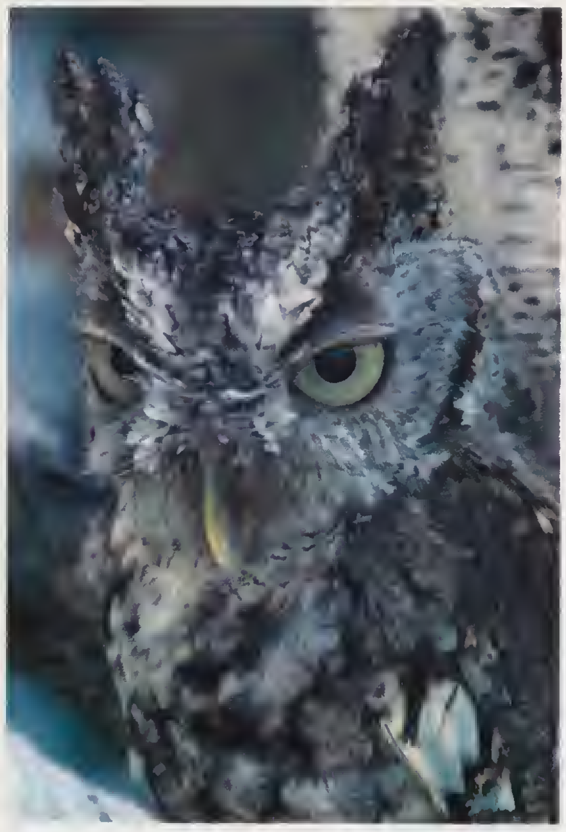
This common woodland owl may be found in parks, orchards or small woodlots, sometimes close to towns and villages. In fact, in the spring of 1980, a pair nested on the Cornell University campus where, from their tree hollow, the birds peered at passing students.

By day these birds hide in tree cavities or among thick foliage, and when startled, they may stretch tall and hold their wings close to their back, simulating dead stubs of tree branches.

Screech owls occur in two distinct color phases—red and gray—which apparently are not related to sex, age or season. Both phases may occur among young in the same nest.

These small but aggressive owls feed upon a wide variety of mammals, birds, reptiles, amphibians, fish, crustaceans, and insects. They can capture and kill prey larger than themselves, and in turn, can fall prey to larger owls or hawks.

Art Wolfe



Gary Maszaros

SAW-WHET OWLS spend most of the day quietly roosting in the thick foliage close to the ground. They often are found in dark coniferous forests or moist or swampy woodlands.

The name saw-whet derives from one of the owl's calls, a series of two-syllable notes that sound like the rasping of a file sharpening a saw.

Unlike many other owls, adult and immature saw-whet owls are strikingly dissimilar in appearance. The adult has a dark brown back with white mottling, and underparts that are white with wide, vertical, reddish-brown stripes. The immature bird is a nearly solid chocolate brown, with white eyebrows.

Saw-whet owls feed primarily on mice, but will eat other small mammals and a few birds, including some that are larger than themselves. ▶

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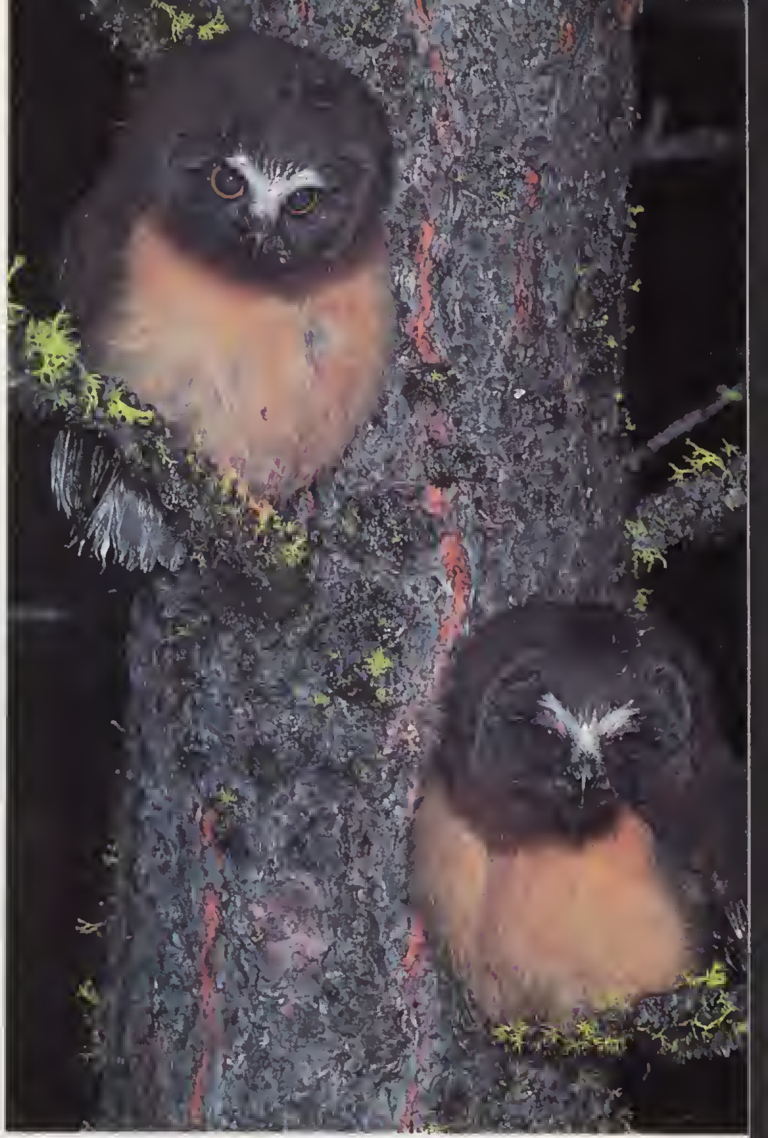

Art Wolf

BARN OWLS ARE pale white owls that often nest in abandoned buildings and doubtless have given rise to tales of phantoms in haunted houses. Their ghostlike appearance and unearthly shrieks, howls, and moans have certainly contributed to the age-old association between owls and the unknown.

This owl prefers to hunt open country and often is seen near fields, farmyards, and woodland edges. It also takes advantage of mice and rats in barns, church steeples, factory attics, and warehouses. The nocturnal nature of this species prevails even when it is pressed for food.

Barn owls may nest in tree cavities or hollows in the ground, and under these conditions, nests are no more than a few feathers mixed with incidental materials found in the hollow. In buildings, nests are composed mainly of rubbish.

When approached or surprised, barn owls express warning by lowering the head and swinging it to and fro close to the ground, or by stretching forward, dropping the wings, hissing and snapping the bill.

Like short-eared owls, barn owls may be gregarious outside of the breeding season. In the fall, numbers of barn owls in southern areas increase, suggesting a partial migration.

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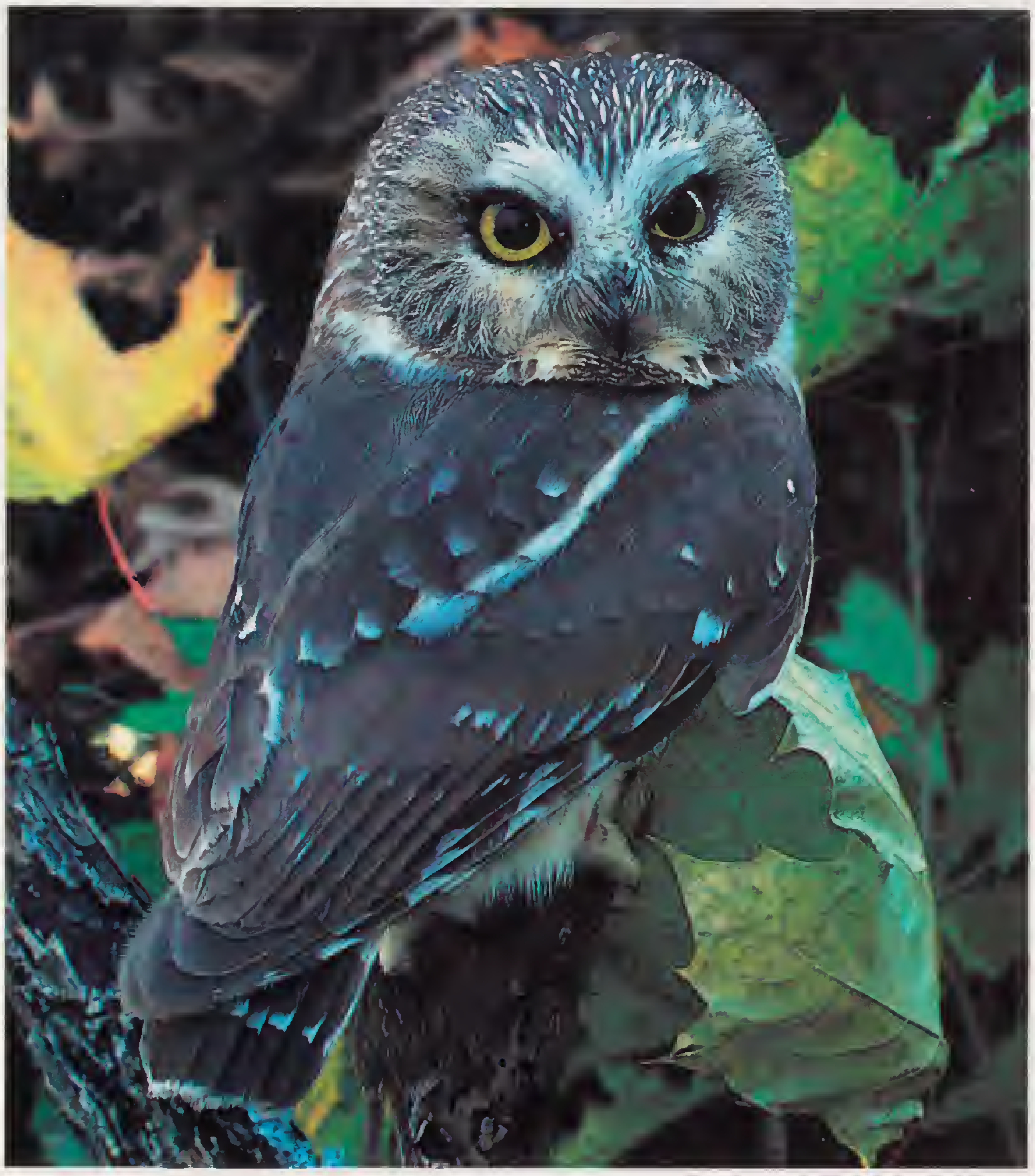


Gary Maszaros

A Big Owl Watches the Hand That Portrays It

by George Miksch Sutton

WHILE A "GRAD" and faculty member at Cornell 50 years ago I heard many versions of a charming story about the great bird artist, Louis Agassiz Fuertes, and a farmer who had caught a great horned owl, *Bubo virginianus,* red-handed in a henhouse. My version of the story is entertaining but it's probably not as authoritative as that of the late Hugh Breckenridge, a close friend of the Fuertes family. The Breckenridge version, as published in Mary Fuertes Boynton's book *Louis Agassiz Fuertes His Life Briefly Told and His Correspondence Edited* (1956, Oxford University Press, New York, pp. 195–196) goes thus:

"One time when Uncle Louis went to the phone . . . a country voice said: 'Say, Professor, I got one of them big old-fashioned hoot owls and I want you to take a look at him.' L.A.F.: 'Where is he?' Country Voice: 'I got him down here to Higgins Feed Store in the winder.' L.A.F.: 'Well, I wasn't planning to go downtown to-day, but if I do I'll stop and see him. (After discussing the tremendous size of owl . . .) Good-bye.' Later Uncle Louis had some business downtown and went to the feed store, and there was a male great horned owl in the window and a rustic in a mackinaw standing by outside with a proprietary air. As Louis looked at the owl the countryman sidled up and said: 'Big one, ain't he?' Louis said: 'Yes, and if it were a female, it would be even bigger.' The man bridled. 'Is that so? Well, let me tell you something, mister. Per-fessor Fuertes was here and seen him and he said it was the biggest one he ever see.' Louis slunk away."

It's an interesting fact that as a boy in Nebraska, Minnesota, and Oregon I never saw a living great horn in the wilds. In Albert Lano's fine collection of birdskins in Aitkin, Minnesota there were several specimens of the handsome bird, and these I handled with a feeling close to awe. Those curved, steel-hard, needle-sharp claws! My copy of Frank Chapman's *Bird-Life* told me that the great horn lived "only in the wilder, more heavily wooded parts of the country," a statement that didn't help much. Indeed what I knew about great horns could be summed up tersely: they were killers. In Ernest Thompson Seton's *Wild Animals I Have Known,* it was a great horn that ended the life of poor Redruff, the "partridge" of the Don Valley. In those days I didn't know that the ruffed grouse, *Bonasa umbellus,* was known as the partridge in some parts of its wide range.

It was in West Virginia, very early one spring, that I came face to face at last with a wild great horn. An inch of snow covered the ground. Near the mouth of Jordan Run, a tributary to Buffalo Creek, I happened upon a ragged old nest—probably a squirrel's—over the edge of which peered down a creature that looked like a cat. I knew at once that it was a great horn. When I started to climb the tree the owl flew off, scattering in all directions the snow that had gathered on its back. There were two eggs, white, almost spherical, incredibly beautiful. What a day to remember! The eggs hatched. The chicks grew larger daily. In due season they fledged, faced with the problem of catching rats, cottontails, and squirrels on their own.

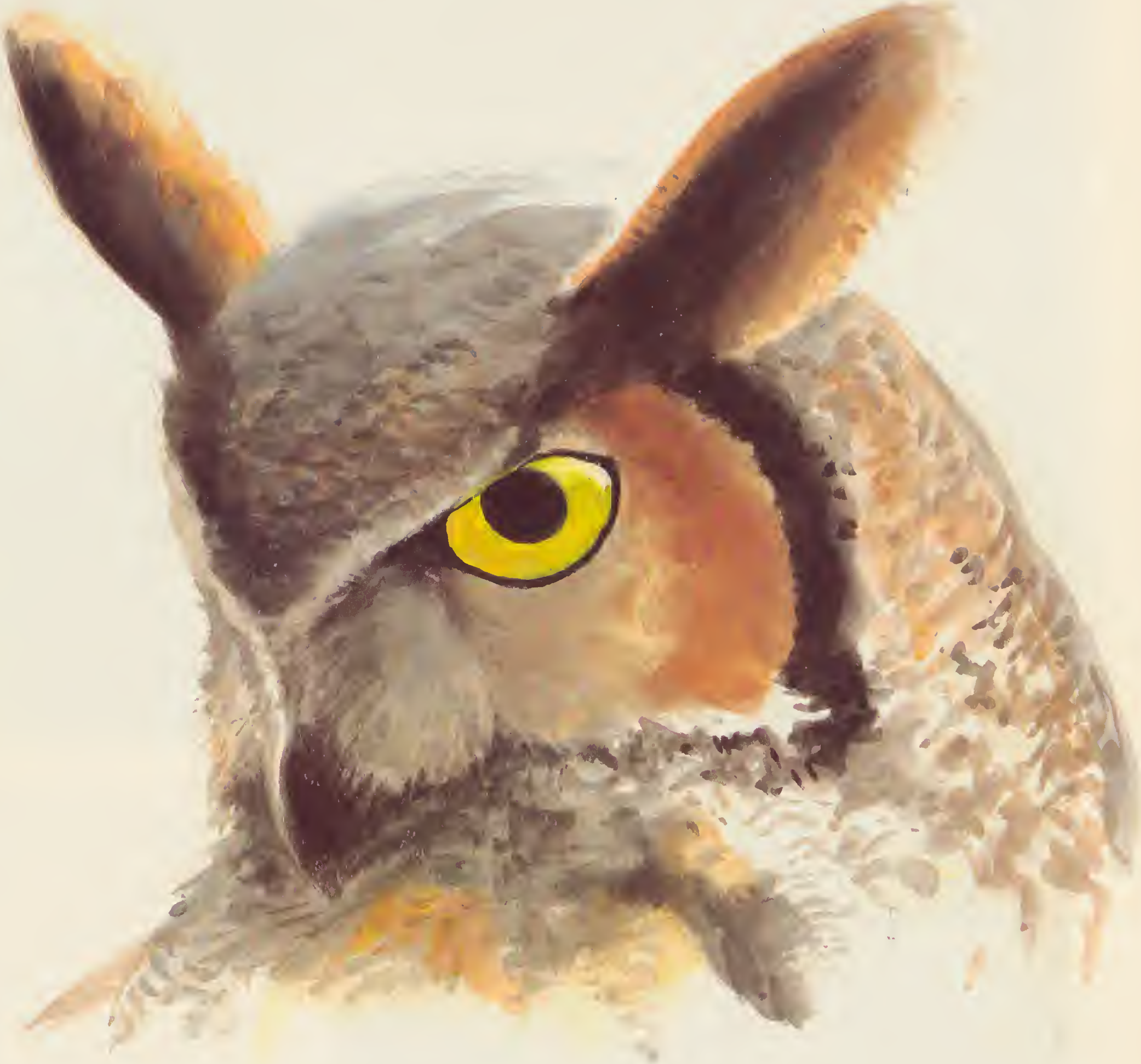
In West Virginia someone gave me a young great horn that I raised as a "pet." It was never very tame, but it swallowed great numbers of rats and mice that kids of the neighborhood brought it. I was glad when it became old enough to obtain its own food. I liberated it a long way from town, hoping that I'd never see it again.

As state ornithologist of Pennsylvania (1924–1929) I saw little of the great horn in the wilds but was deeply interested in examining the stomachs of the scores of owls that were sent to the game commission's office for bounty payment. What my assistant, Leo Luttringer, and I found was about what we expected, namely, proof that there was some justification for the great horn's unpopularity. It was, indeed, a destroyer of game and poultry. One owl that I was told about was so persistent in stealing chickens that it was caught twice in steel traps set on fenceposts. Caught the first time, it pulled itself free, trap and all. The following night it was caught again—with a trap on each foot.

Through year after year of dealing with the great horn I never felt the urge to draw one from life. I have often wondered why. Then, at the University of Michigan one day, someone brought in a great horn that had appeal. It was big, beautifully feathered, and docile. After being talked to a bit it submitted to having its feathered toes stroked. It gave up popping its bill unless startled by the slamming of a door. I settled down with pencil, eraser, brushes, and the old Fuertes paintbox, and did a portrait of the owl's head. While I worked, my model never looked at my face. What it watched was my right hand. That hand seemed to fascinate it. Its facial expression was at times a bit frightening. What, I thought, if that owl should decide to pounce on one of those fingers? For all I knew they might look like weasels to the owl!

THE AUTHOR AND ARTIST

George Miksch Sutton (1898–1982) was an artist, author, and lecturer and George Lynn Cross research professor of Zoology Emeritus and Curator of Birds, Stovall Museum of Science and History, University of Oklahoma.



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Return of the Natives

by **Peter E. Nye and Michael L. Allen**

The last pair of nesting bald eagles in New York State become foster parents.

Michael Allen prepares eaglet for ascent to nest. Eagles on protected Adak Island, Alaska have no trouble nesting on their own.

Peter Nye

Stephen J. Krasemann/DRK Photo

IN A WAY, they were lucky. Despite intense competition with humans for preferred lakeshore habitat, indiscriminate killing by irresponsible gunmen, and environmental contamination from DDT, they had survived to become the last pair of native nesting bald eagles in New York State.

However, they were not really lucky at all. Although they steadfastly clung to their territory and acted like other bald eagles, they were unable to perform one key function: they could not produce young. That meant that after their deaths, bald eagles would nest in New York no longer.

That's the bad news. The good news is that in 1976 our agency, New York State Department of Environmental Conservation, made a commitment to restore endangered species in the state, beginning with the bald eagle. Slowly, carefully, and with precious little knowledge, we decided to fight to bring back the disappearing bald eagle population to New York.

We knew a few things when we began. This last resident pair of bald eagles had nested in the same tree in western New York for over 20 years. The nest itself, 85 feet above the ground, is a carefully constructed pile of sticks. Each year the pair adds to the pile so that now it is eight feet deep and six feet across at the top. Only once since 1965 have they successfully fledged young, and then just one. In the past, at least 72 bald eagle nesting sites are known to have been active in New York State.

The ills that have befallen our national symbol have been caused by man. Besides the chronic problem of loss of living and feeding space, we know that the acute culprit was DDT. Considered a boon in the 1950s and 60s, this pesticide affected the reproductive system of birds of prey, resulting in eggs with shells so thin they broke during incubation. Production of bald eagles, peregrine falcons and ospreys took a nose dive during the 1960s and 70s, particularly in the eastern United States.

Our objective with this last remaining pair was twofold: first, to attempt to fledge eagle chicks from this site again; second, to keep the adults from abandoning this site and territory. We knew that the female was laying contaminated eggs, with shells nearly one-third thinner than normal and that they broke before hatching. However, these birds were of great importance to us since they could serve as foster parents, raising chicks other than their own.

Our first task in making the pair foster parents was to learn everything we could about them; their habits and behavior were critical to successful parenting. In the spring of 1976 we began monitoring the nest continuously and keeping a detailed account of the activities of these sensitive birds. From our observations we concluded that the eagles were carrying out the initial reproductive process leading to egg laying, but then the eggs broke and the pair abandoned the site for the remainder of the breeding season.

Our course was clear: somehow, prior to the eggs breaking, remove them and substitute either normal eggs or young and thereby "trick" the adults into "thinking" they were raising their own offspring.

This seemingly simple approach raised many questions. How would the adult eagles react to our tampering with the nest? If we inserted young into it, would the pair care for them or kill them? The 1977 nesting season was our first chance to test the pair's reaction to our disturbances.

BHL

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March, 1977. Observations revealed that the male and female eagles had come back to the site from the south and were rebuilding their nest. On March 19 the female laid an addled egg and began incubating it. Seven days later we removed the egg and replaced it with two viable red-tailed hawk eggs (rather than risk real eagle eggs), and one "dummy" egg containing a radio transmitter. The heat- and light-sensitive telemetric egg provided us with information on the pair's incubation activity. We hoped that the red-tailed hawk eggs might hatch under the adults, be accepted and reared.

During the transfer both adults were at the site but they left shortly after and did not return for three days. Upon their arrival back to the nest they settled into an incubation posture and maintained it for the normal period of 34 days. (The telemetric egg, noticeably smaller than the others and with a visible seam, was accepted along with the real eggs.) Since the red-tailed hawk eggs did not hatch at the end of that time, we decided to substitute chicks for the eggs. So we placed two five day old red-tailed chicks in the nest and, although the adults were nearby during the exchange, they left the area and did not return for the remainder of the season.

Why the pair did not accept the chicks is open to speculation. Perhaps they were too small or too young. Perhaps the pair had been disturbed too often during the nesting period. Although we had failed during our 1977 fostering attempt, we had learned that the pair would accept an intrusion and egg replacement.

Based on that knowledge, we made two important changes in our strategy for 1978. First, we would disturb the pair only once during the nesting process, and second, we would use a bald eagle chick rather than a red-tailed hawk. Timing was crucial: the adults had to incubate their own egg long enough to hold them to the nesting process. However, if they incubated too long the egg would be broken and the nest abandoned for the season.

March, 1978. Incubation began and was sincere and continuous. After 26 days we removed the pair's egg and replaced it with a two-and-a-half week old eaglet hatched by captive parents at the U. S. Fish and Wildlife Service's Patuxent Wildlife Research Center in Maryland.

The adult eagles returned to the nest five minutes after the crew left the tree and accepted the foster chick immediately. Once accepted, we were confident that normal rearing would take place. And so it did. The eaglet went on to fledge in late June, marking the first eagle fledged from a wild nest in New York in five years.

The fact that we had disturbed the pair only once during the 1978 attempt may have contributed to our success. Also, the attractiveness of a larger, older chick and our improved technique for approaching the nest, indirectly yet in full view of the adults, may have helped.

April, 1979. After our success in 1978, we felt we had a workable technique and we knew this adult pair was capable of raising young. Unfortunately, during early observations we began noticing problems. Although the pair returned to the territory on schedule, decorated the nest with sticks, and copulated, incubation was sporadic. To our surprise, upon reaching the nest, we discovered no egg; rather, the pair had been incubating a damp clump of vegetation. We found no evidence of an egg, such as eggshell fragments. This would explain the pair's seemingly inattentive incubation behavior. In light of this, we decided to attempt a chick transfer as soon as possible.

Two eaglets from Patuxent were flown to the nest and left there for eight hours. The adults soared near the nest all day, but they did not return. Nesting activities at the site then ceased for the remainder of the season and the eaglets were sent back to Maryland.

February, 1980. This season we had the new problem that the pair again might not have their own egg, the most important element in stimulating normal incubation and in setting the stage for chick implant and acceptance.

Our observations at the site throughout March indicated that, in fact, the pair did not have an egg. If we allowed them to continue this way they would abandon the nesting attempt for the season. Thus in early April we climbed to the nest and placed the telemetric egg into it. As predicted, no

Make it a memory
EAGLES FOR SALE.
20

Eaglet arrives from Patuxent and is placed in nest. Thin-shelled natural egg is removed.

Michael Allen

Dept. of Environmental Conservation

natural egg was present. Both adults left the nesting area with this intrusion and did not return for four days, this behavior being similar to their three-day disappearance during the 1977 egg implant. Upon their return, however, incubation of the telemetric egg began immediately and continued for three weeks. Meanwhile we made plans with Patuxent to secure an eaglet of the required age, and on April 26 a three week old chick dubbed "Shazam" was placed into the nest in exchange for the artificial egg.

For the first time since manipulations began, the female remained in the vicinity during our activity. Five minutes after Shazam was placed in the nest the female returned and began brooding. The male returned an hour later. The pair displayed excellent parental qualities, never leaving the youngster hungry, and to our delight the eaglet fledged around June 20. We were pleased to conclude that the telemetric egg worked in inducing and holding the adults in incubation. We had tricked this resident pair into maintaining their nesting activity and had fledged another young eagle into New York's skies.

January, 1981. All was going well when we were first shocked and then depressed to hear that an adult eagle had been found dead less than a mile from the nest site. A post-mortem examination revealed that it was a male and that it had been shot. Since our nesting birds had not been banded or marked, we could not be certain that this was our resident male, but we were worried. Our fears worsened in late February when the female eagle did not return to the eyrie as she had around February 20 for the past 20 years. Although we searched for ideas to keep the site active, including tethering another potential mate near the nest, we were beginning to think the situation was hopeless.

On March 13, however, we were again shocked but this time elated to see the female back at the nest. Miraculously, she was accompanied by a new mate! What was more rewarding was that this new male had been released by our department as part of another restoration program. We knew from the wing marker that he had fledged from a site 54 miles east of this nest.

Although the new pair appeared conscientious and went through typical courtship activities, we had no reason to believe that our old, polluted female would lay an egg. (The male does not contribute to egg contamination.) So on April 23 we introduced two eaglets to the nest following the usual acceptance and incubation of our artificial egg. The eaglets were accepted immediately and both went on to fledge in late June. Our new male had performed admirably in his role as foster parent, and thus we had again achieved continuity of this nesting territory. We concluded also that eagles can't count, since two chicks were accepted for a single egg.

We do not know why the female stopped laying eggs in 1979, but she had indeed stopped since we found no eggs in 1980 and 1981. We are fairly certain we are dealing with the same female each year, and she may be 25 years old. Whether she is too old to lay (although some biologists suggest birds lay eggs until they die), or too contaminated, or both, is unknown. We do know that to keep the site active with this female we must insert a dummy egg into the nest early each nesting season.

April, 1982. The season went well and the new male and the old female fledged two more foster chicks from Patuxent.

While we don't want to get too comfortable, it appears that the female tolerates our intrusions and accepts the egg, then chicks, more readily each year. With the help of our pair we have fledged a total of six young eagles, the largest number in New York since 1950. Without intervention the eagles never would have had the chance to continue their kind here.

We are encouraged by our success and have allowed ourselves to think about the spring when our old female will not return. We hope our male will then secure a new, uncontaminated mate, bringing the process full circle. Perhaps, by clinging to what we have left and assisting in any way we can, we may one day right the wrongs we have perpetrated against our fellow life forms such as the bald eagle.

Stephen J. Krasemann/DRK Photo

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THE AUTHORS

Peter Nye and Michael Allen are researchers at the New York State Department of Environmental Conservation.

To Save the Condor

by Stanley A. Temple

An INDIAN SHEEPHERDER tending his flock in the Peruvian Andes pauses to watch the flight of a huge Andean condor soaring overhead. Unknown to the herder, other men a hundred miles away are also tracing this particular condor's flight. They are scientists who have been tracking the bird's movements for two years by monitoring signals generated by a solar-powered miniature radio transmitter mounted on the condor's wing.

Although the herder will note nothing unusual about this bird, it is no ordinary condor. Its parents, which it has never seen, live in a cage at the U.S. Fish and Wildlife Service's Patuxent Wildlife Research Center in Maryland; it hatched in an incubator at the New York Zoological Society's Bronx Zoo, and it was hand-reared by University of Wisconsin biologists before being released into the wilds of Peru. This Andean condor has taken on special significance to conservationists around the world because someday it may play a crucial role in saving the endangered California condor from extinction.

With a population of only 20 to 30 individuals and a loss of about two birds a year, the California condor needs whatever help we can offer and it needs it soon. To ensure that our attempts to save the California condor have the best possible chance of succeeding, we have been working with the best possible surrogate, the Andean condor.

Plans for rescuing the California condor include three procedures: captive breeding, release of captive-reared birds into the wild, and studying wild condors with the aid of radio tracking. These techniques have never been used on the California condor, so we first tested them on the Andean condor.

Because of the high risk of leaving California condors to their own devices in the wild where they continue to decline, captive breeding offers some attractive features. Well-managed captive birds often live longer and are more productive than wild birds; at best these birds in the wild are able to raise one young every second year. Hoping that captive condors might breed at a higher rate and live longer, the U.S. Fish and Wildlife Service began experimental propagation of Andean condors in 1966. Initially, nine immature birds were trapped in Argentina and shipped to Patuxent. After trading with zoos to get a balanced sex ratio and waiting for the birds to reach sexual maturity, four breeding pairs were formed. The first egg was laid in 1971 and the first chick hatched in 1973. By 1978 all four pairs were productive. Meanwhile, several zoos also had been successful at breeding condors.

After establishing that condors could be bred in captivity, the next step was to increase their reproductive rate. Like California condors, wild Andean condors nest only once every other year. However, in captivity we can induce the birds to breed every year by removing the previous year's youngster before its presence inhibits the adults' subsequent breeding. Pushing the birds even further, researchers at the Bronx Zoo have found they can get their captive condors to lay more than one egg each year. Removal of the condor's first egg leads to the laying of a second replacement egg. If the second egg is removed, some condor pairs have laid even a third egg. By hatching these eggs in an incubator it has been possible to induce a pair of captive Andean condors to produce six young during the same two-year period in which a wild pair could produce only one. Such an increase in reproduction is what is needed to bolster the precariously small population of California condors.

U.S. Fish & Wildlife Service/Tupper Ansel Blake

Left: *Captive male California condor.*
Right: *California condor chick in nest cave. In nature, a chick hatches every other year.*

© Kenneth W. Fink (Bruce Coleman, Inc.)

Most captive Andean condors kept in adequate breeding cages have reproduced, and the prognosis for using this method with California condors is excellent. If they breed in captivity as well as their South American relatives, they could reach a safe population size in a few decades.

As promising as captive breeding seems to be, most conservationists would prefer that condors reside in the wild rather than in cages. Condors raised in captivity would have to be released to the wild and this presents many challenges. Unlike smaller birds that mature quickly and become independent of their parents, the larger condors do not reach maturity until the age of about 10 years. A young bird remains with its parents for almost a year before striking out on its own. Birds produced in captivity would not have the benefit of this long period of parental care; once released they would have to adjust to natural conditions without parents to serve as role models.

One of my graduate students, Michael P. Wallace, and I undertook the task of developing procedures for returning captive-produced condors to the wild. We began our work in 1978 with preliminary experiments on turkey vultures and black vultures, both smaller and more abundant relatives of condors. We found that, with special attention, these birds could be released using a modification of the hacking process that has proven successful in the peregrine falcon recovery program. Our follow-up observations have shown that these hand-rearing and releasing procedures have resulted in apparently normal, wild individuals.

Encouraged by this success, we prepared to use the best of the tested techniques on the Andean condors. By 1980 enough young Andean condors had been produced in captivity to provide an adequate number of birds for release experiments. We selected an area on the Sechura Peninsula in the remote coastal desert of northern Peru. It is frequented by wild condors and has the rugged topography and natural food supply required by the birds. The area also has minimal human disturbance.

In July, 1980 the first group of six captive-reared condors was shipped to Peru and released on the Sechura Peninsula a month later. These birds were at least one year old, and soon they began ranging about the peninsula in search of animal carcasses that we moved from place to place to encourage the birds to expand their foraging area. Gradually they became capable of finding natural food and behaved more and more like wild condors. In December, 1980, five birds were added, these being less than one year old.

We continued to monitor the birds through August, 1982, and we were pleased with their progress. Seven of the 11 birds made a successful transition to life in the wild, and by the time we left them they were indistinguishable from wild birds of similar age. The four birds that died taught us much about the perils of being a young condor. Two of the released birds became sick and died soon after they fed on the carcasses of dead seabirds along the coast. We suspect that the condors, which had been fed a relatively sanitary diet in captivity, had problems coping with the microorganisms they encountered in putrid carcasses. Just as human travelers suffer from intestinal problems when they visit a strange land and eat unusual foods, so our released condors apparently suffered. This experience taught us that we should prepare captive birds for the types of food they will eat in the wild.

A third released bird died of starvation when inclement weather forced it down among a group of wild adult condors. When food is short, adults have primary access to it, and younger condors, like this released bird, are the ones that suffer. The fourth unsuccessful condor apparently died of injuries resulting from either a fall off a roosting ledge on a cliff or a collision with the face of a cliff. All in all, though, seven out of 11 is a very high success rate in comparison with mortality rates of 50 percent or more that seems typical of wild vultures during their first year of life. At this point we think returning captive-bred condors to the wild presents no insurmountable hurdles.

Adult Andean condors and tagged subadult, turkey vultures, black vultures at bait site in Peru.

Michael Wallace

As part of our work with Andean condors in Peru, we perfected a method of attaching two-ounce radio transmitters to the top of a condor's wing. These tell us the wearer's precise location and behavior. Condors search for food over a huge range; in Peru they traverse daily more than 100 miles of some of the most rugged terrain on earth. This combination of great mobility and rugged landscape means that traditional observation techniques are ineffective. With binoculars or spotting scopes we would be lucky to keep a foraging bird in sight for even a brief portion of its daily routine before it vanished behind a mountain peak.

Radio tracking is an important key to our understanding of condor biology. Trying to study the California condor using traditional techniques has left many questions unanswered, some crucial to the recovery and management of the bird. We do not know where most of the California condors are at any time, or where they get their food, or the types of habitats they use for nesting and roosting. We do not know why condors die.

Some conservationists are justifiably nervous about the use of radio telemetry because the birds must be captured and fitted with the apparatus. But our experience with wild Andean condors in Peru should allay apprehensions. We radioed 58 condors for up to two years, and they showed no adverse reactions. In several instances the tracking information helped to rescue birds that might have died. Two of our captive-reared and released birds bathed in a pool containing oil run-off from a petroleum pipeline. We were able to find them and clean their feathers. Without the tracking data these birds probably would have died. We radio tracked wild condors into an area of the Andes where a sheepherder had placed poison bait for mountain lions that were killing his sheep. The poisoned carcasses also attracted our condors. We contacted the herder and warned him of the risks.

Radio tracking has tremendous potential for helping the California condor recovery program. This information will be invaluable if captive breeding of California condors succeeds and the day comes for releasing progeny into the wild. In the meantime, radio tracking may reveal problems in the wild population that can be corrected. Recently, in fact, two wild, immature California condors were trapped, fitted with radio transmitters, and released. Already the tracking results are telling us things we did not know.

Without the success of all three parts of the proposed program—radio tracking, captive breeding, and restocking—the future of the California condor must be judged bleak. Work with Andean condors has shown that these recovery techniques can work. Still, it remains unclear if even these advanced conservation procedures have come in time to save the California condor.

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THE AUTHOR

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Michael Wallace

Michael Wallace

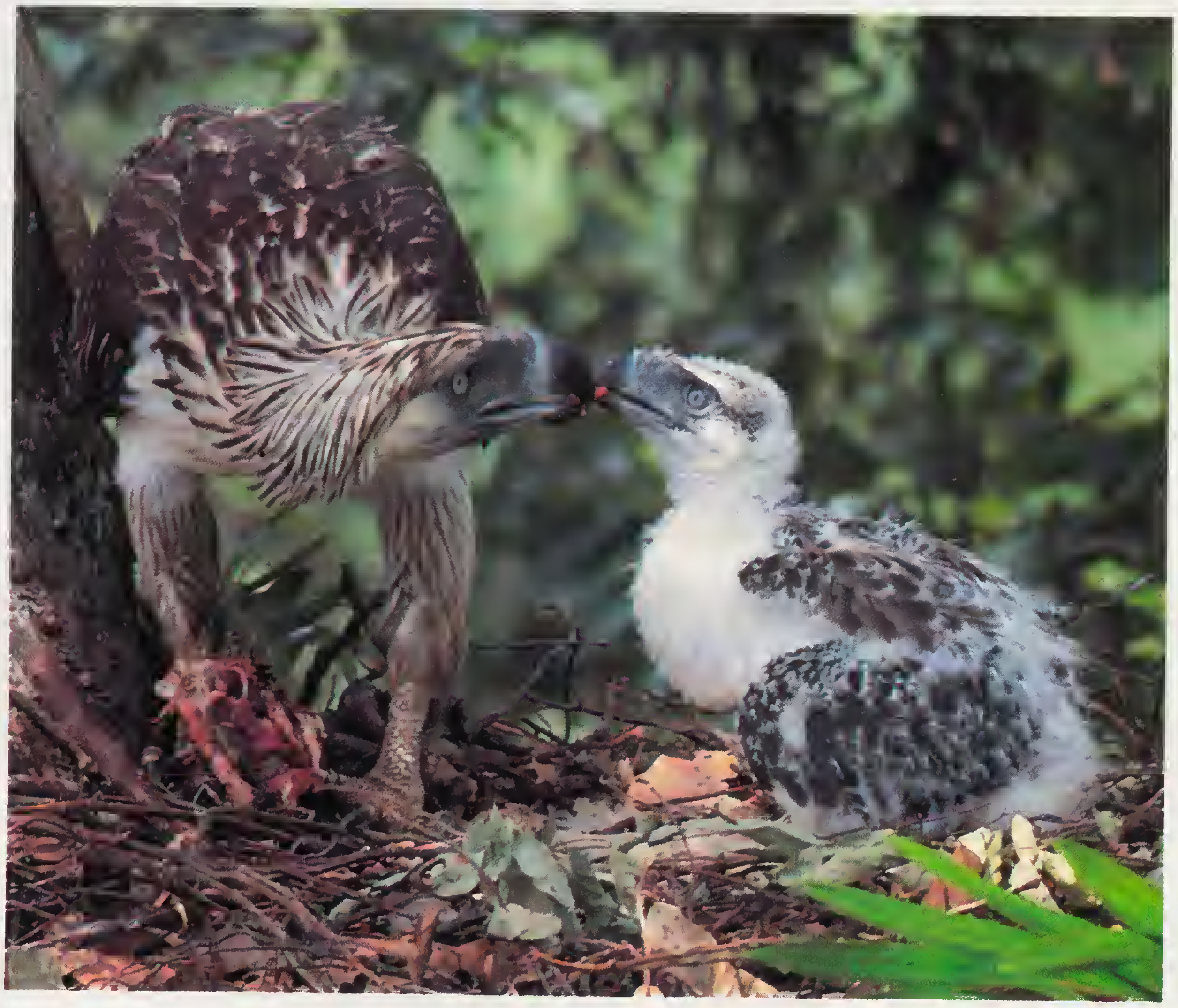
John Ogden

Top: *Andean condor, produced in the U.S., is weighed before released in Peru.* **Left:** *Wing tags help identify freed birds.* **Right:** *One of the few known breeding California condors is fitted with transmitter.*

Neil Rettig

Out on a Limb

The Philippine eagle, found exclusively on the islands of Luzon, Samar, Leyte, and Mindanao in the Philippine Islands, is the world's second largest eagle and one of the rarest. Its nest is a huge platform of sticks built high in the binuang, tangile, and lauan trees of the rain forest. The Philippine eagle is distinctive for its crest of long, tapered feathers, blue-gray eyes, and size—it measures up to three-and-a-half feet in length. Its former name, "monkey-eating" eagle has been changed, monkeys being but a small part of the bird's diet.



Neil Rettig

RESEARCH & REVIEW

by Richard E. Bonney, Jr.

Pesticide Threat

A pesticide known as endrin made the news in the spring of 1981 when it was sprayed on 330,000 acres of wheat in Montana and neighboring states. This one-time spraying was an effort to control pale western (army) cutworms. By late summer, Montana wildlife officials discovered that some waterfowl, which apparently had fed on contaminated wheat, contained endrin concentrations equivalent to three times the amount considered safe to humans by the U.S. Environmental Protection Agency (EPA).

Concern for the health of those who might eat the contaminated birds nearly resulted in cancellation of waterfowl hunting seasons in Montana and 16 other states over which the birds migrate. While the seasons were not closed, hunters were advised of the health risks.

Endrin is related to the strictly controlled pesticide, DDT. Studies where pesticides were fed to mallard ducklings, though, have suggested that endrin is 80 times more toxic than DDT. It is known that endrin, when ingested in sufficient quantity, can cause birds to die of poisoning. Less known are the potential effects of endrin on avian reproduction which in the long run may be even more significant.

Three U.S. Fish and Wildlife Service researchers have recently investigated the effects of dietary endrin on screech owl reproduction ("Endrin decreases screech owl productivity," *Journal of Wildlife Management*, vol. 46, pp. 462–468).

W. James Fleming, M. Anne Ross McLane, and Eugene Cromartie worked with 30 breeding pairs of screech owls from a colony at the Patuxent Wildlife Research Center in Maryland. Half of the birds were randomly chosen to receive endrin in their food. The amount of endrin fed to these birds (.75 parts per million) was a concentration that may occur in prey items after a spraying. The other 15 owl pairs served as controls. They were fed no endrin.

The researchers found that the endrin-fed owls laid fewer eggs, hatched fewer eggs per clutch, and overall produced 43 percent fewer fledglings than the control birds. Also, endrin residue was found in eggs from the endrin-treated group, whereas no endrin residue was found in eggs from the control group (although most eggs from both groups contained residues of a DDT derivative and PCB).

Fleming and his colleagues noted that endrin did not affect eggshell thickness, thus the decline in screech owl hatching success must have been caused by some other factor. (The eggshell thinning phenomenon associated with DDT has endangered such birds as the bald eagle and peregrine falcon.) Exactly how endrin affects breeding success is not yet known. Apparently, survival of the screech owls that did hatch was not affected by the endrin treatment of their parents.

The use of endrin is now forbidden in the eastern United States but still may be used under certain circumstances in the west. Yet one U.S. Fish and Wildlife Service biologist has referred to endrin as "stone-age pest control," noting that alternative pesticides exist that are more selective and less poisonous. Many environmental organizations have requested the EPA to ban all endrin. Given that the waterfowl affected by the spraying are an important part of the hunting industry, maybe such a ban will become a reality.

Optimal Foraging

In the animal world, survival requires a never-ending quest for food. Almost everything a bird does relates to obtaining food: territories are defended to ensure exclusive food supplies, migrations are undertaken to areas of greater food abundance, behavioral and structural adaptations evolve to aid in the capture or handling of food.

The quest for food is really a quest for energy. From ingested food comes the energy that fuels cellular processes that in turn enable survival, growth, and reproduction. Yet, the amount of energy a bird gets from food is not equal to the amount of food it eats. Energy is gained only when the energy value of ingested food is greater than the energy expended in finding, eating, and digesting the food.

Logically, a foraging bird should attempt to capture a large amount of prey while expending a small amount of energy, thereby maximizing its energy gain. This idea is known as "optimal foraging theory," and it raises the question—shouldn't a bird hunt in areas where its preferred foods are in greatest abundance?

This question has been examined recently by two independent studies, both of which deal with relationships between prey abundance and feeding sites. The studies differed in intent and approach, but the findings and conclusions are similar.

In the first study, James Baker and Ronald Brooks of the University of Guelph, Ontario, investigated the number of wintering red-tailed hawks and rough-legged hawks on six different types of habitats at the Toronto International Airport ("Distribution patterns of raptors in relation to density of meadow voles," *The Condor*, vol. 83, pp. 42–47). Each habitat type supported differing densities of meadow vole, a small mouse constituting about 85 percent of the diet of both red-tailed and rough-legged hawks at the airport.

The habitats were as follows: shortgrass, dominated by mowed bluegrass; old fields, largely abandoned farm fields; straw, harvested winter wheat that was left in the fields over winter; pasture, grazed by cattle and having very little vegetation; plowed fields, plowed in early fall and left fallow over winter; and winter wheat, sown in September and offering very little winter cover.

The two-year study consisted of three parts. First, the researchers estimated the number of voles on each habitat. Second, they determined the number of hawks using each habitat. Third, they examined the relationships between vole densities and hawk densities for each habitat.

Vole densities differed markedly among the habitats. The straw supported the greatest number of voles, from 125 to 360 voles per hectare (2.5 acres), depending on the month. Shortgrass and old field habitats also supported high vole densities, from 10 to 340 voles per hectare. Shortgrass usually supported higher densities than old fields. Pastures had very few voles, probably fewer than four per hectare, and no voles ever were seen on plowed fields or fields of winter wheat.

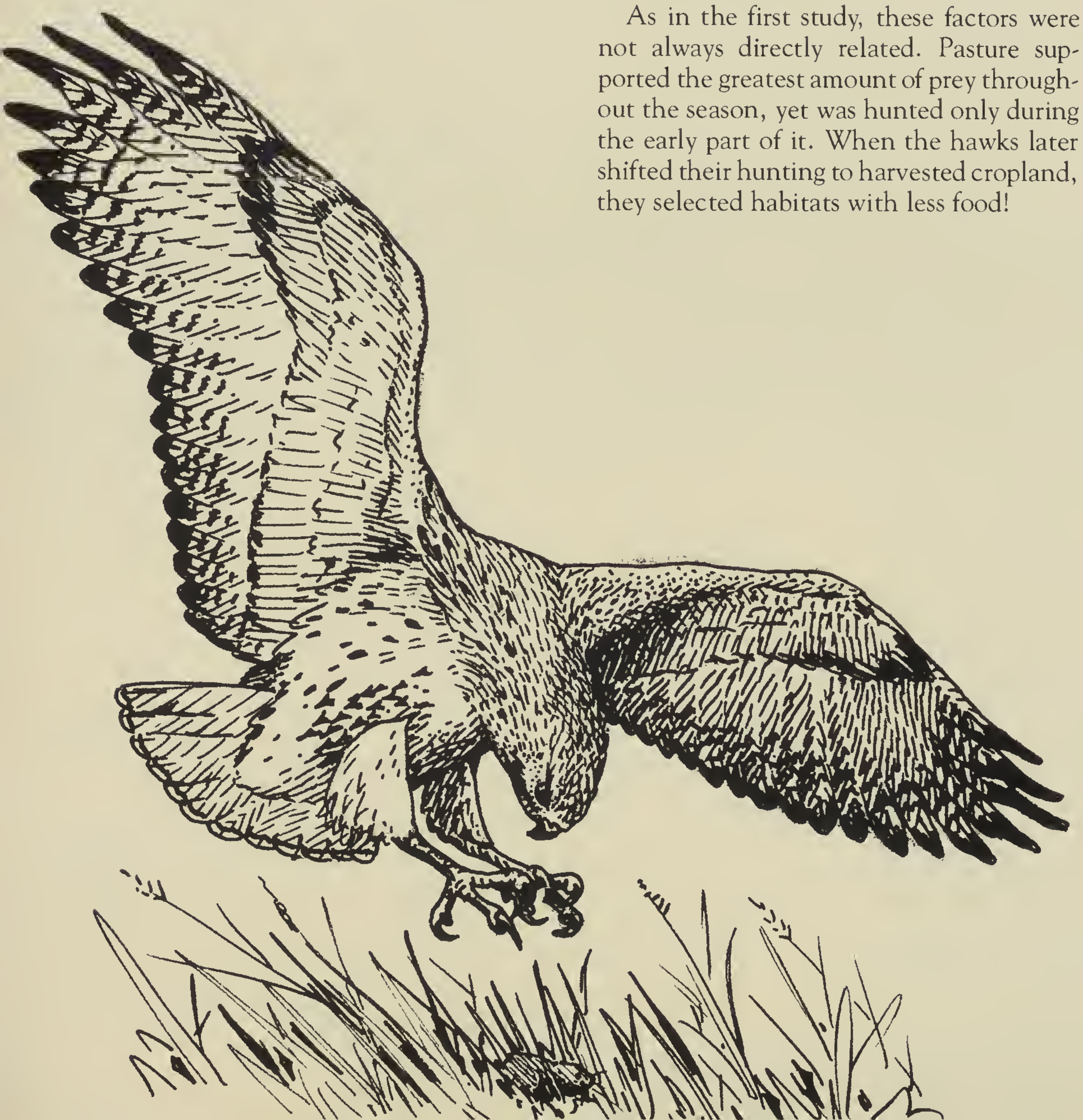
If the hawks were feeding in habitats solely on the basis of prey abundance, then they should have been found at highest densities in straw, followed by shortgrass, old fields, and pasture. No hawks should have occurred over plowed fields or winter wheat.

Yet this is not what Baker and Brooks discovered. The red-tails did concentrate on shortgrass and old fields, both of which had high vole densities. However, they were found in pastures, with low vole densities, more than straw, which supported the highest vole density of all. They were seen even in the plowed fields and winter wheat, which apparently were devoid of prey.

As for the rough-legs, they too were found in shortgrass more than straw, although they were found in straw more than in old fields. They also hunted the winter wheat and plowed fields to a surprising degree.

Baker and Brooks concluded that the hawks were not using the habitats strictly on the basis of vole density. In particular, the straw habitat was used much less than expected. The researchers feel this discrepancy exists because each habitat offers differing opportunities for prey concealment. The straw habitat, while having the greatest number of voles, also provided tall, dense prey cover. Conversely, the plowed field and winter wheat habitats, which apparently harbored few if any voles, supported the least cover. Thus, the few voles that might appear would be easy targets.

There is further although indirect support for the idea that cover affected the hawks' hunting opportunities: the fact that rough-legs hunted the straw more than red-tails. Red-tails hunt mainly from perches, whereas rough-legs often hunt by hovering. A vole in straw becomes vulnerable to predation only when it moves into an open space between the rows. A hovering hawk would have a greater chance of capturing the vole than would a hawk perched some distance away.



Vole becomes vulnerable to predation when it moves from cover into an open space.

The second study, by Marc Bechard, Marshall University, Toronto, also examined prey abundance and hawk foraging in different types of habitat ("Effect of vegetative cover on foraging site selection by Swainson's hawk," *The Condor,* vol. 84, pp. 153–159). Working over two nesting seasons in southeastern Washington, Bechard observed four male Swainson's hawks that were providing food for themselves, their brooding mates, and young. Using radio telemetry equipment, he followed the birds to observe their foraging frequencies in four cultivated habitat types: fallow fields, wheat fields, pea fields, and mustard fields, and two uncultivated types: pasture and "eyebrows" (a local term for narrow patches of unplowed land on steep hillsides).

Bechard discovered that early in the nesting season the birds spent the greatest amount of time hunting uncultivated land —the pasture and eyebrows. But, once harvest began, the hawks concentrated on hunting the cultivated land. When the pea harvest started, the foraging hawks moved into the harvested pea fields; later, wheat harvest started and the birds hunted the harvested wheat fields.

Bechard knew that the hawks' prey were northern pocket gophers, deer mice, and voles. So, to correlate foraging patterns with prey abundance, he estimated the gopher, mouse and vole populations within each habitat. Then, he compared the foraging use of each habitat with the amount of prey in the habitat.

As in the first study, these factors were not always directly related. Pasture supported the greatest amount of prey throughout the season, yet was hunted only during the early part of it. When the hawks later shifted their hunting to harvested cropland, they selected habitats with less food!

Yet there was a factor that did correlate with foraging site selection: the amount of vegetative cover on the sites. Bechard found that, during the early part of the season, cover was least in the uncultivated fields where the birds spent most of their time hunting and greatest in the cultivated fields they avoided. After harvest, though, when the hawks moved into the cultivated fields, cover in those fields was much reduced. These hawks—like those in the first study — seemed to be hunting not in the areas with the largest amount of prey, but with the least cover.

These two studies reached the same conclusion independently: prey abundance is not the only factor that determines the selection of hunting areas by certain foraging hawks. Apparently, these hawks maximize energy gain by selecting areas of greatest prey availability — which is determined by both prey abundance and accessibility.

Other factors also enter into a predator's selection of a feeding location, including the amount of competition with other predators, the different types of prey on the site, topography, and weather. How do predators determine the best sites? Perhaps they learn to concentrate search efforts on the basis of initial, successful searches.

Birds and Wildfire

The effects of forest fire on bird populations have not been studied much. Consequently, after a wildfire burned an intensively studied wilderness area in Minnesota, Steven Apfelbaum and Alan Haney seized the opportunity to recensus the area to assess the fire's impact ("Bird populations before and after wildfire in a Great Lakes pine forest," *The Condor,* vol. 83, pp. 347–354).

The fire burned in August and the investigators returned the following May. They discovered numerous changes in the area's vegetation and in the numbers and species of birds present.

Before the fire, the six-hectare (15 acres) study site consisted primarily of jack pine forest with sparse understory, and hosted 12 bird species. These were three species of ground-bush foragers: hermit thrush, ovenbird, and winter wren; two species of trunk foragers: brown creeper and red-breasted nuthatch; and seven species of tree foliage feeders: boreal chickadee, ruby-crowned kinglet, red-eyed and solitary vireos, and three species of warblers.

After the fire, tree cover was reduced severely, but vegetation near the ground—herbs and small woody plants—substantially increased. The number of bird species also increased—from 12 to 14, and many were different. The three ground foragers present before the fire disappeared, and six new ones took their place: purple finch, dark-eyed junco, white-throated sparrow, and three species of thrushes. The number of trunk foragers remained the same, but the nuthatch was replaced by the black-backed three-toed woodpecker. Tree foliage feeders were reduced from seven species to five—both species of vireo disappeared. Finally, an aerial forager, the olive-sided flycatcher, was added.

While the number of bird species increased after the fire, the total number of birds decreased by more than one half, apparently because the fire reduced the amount of food available to birds. But why did the number of species increase? And why did the species composition change?

After the burn, some of the old plants died and new and different ones took their place. Apfelbaum and Haney concluded that the increased diversity of food, especially near the ground, resulted in a greater number of bird species.

NEWS & NOTES

We are sorry to report the death of George Miksch Sutton (1898-1982). Born in Nebraska, he grew up in Minnesota, Oregon, Illinois, Texas, and West Virginia. He graduated from Bethany College in West Virginia. After college, he served on the staff of the Carnegie Museum in Pittsburgh and as state ornithologist for the Pennsylvania Game Commission. In 1929 he undertook a year's solo expedition to the far north. The following year he came to Cornell, first to take his doctorate and later to serve as curator of birds. From 1945 to 1952 he was on the staff of the University of Michigan's Museum of Zoology. His last post was George Lynn Cross research professor of Zoology Emeritus and Curator of Birds at the Stovall Museum of Science and History at the University of Oklahoma.

His direct-from-life stories and sketches have appeared in many books and periodicals including *The Living Bird* and *The Living Bird Quarterly*. Throughout the years, the Laboratory has benefited immeasurably from Doc Sutton's advice and support. He will be missed.

The Laboratory's Cooperative Research Program is a vast base of information on the nesting habits and reproductive success of all birds in North America. These hundreds of thousands of records, contributed by thousands of volunteers throughout the continent, are used to assess changes in bird populations.

We are particularly interested in developing a national research program to study the reproductive success of eastern, western, and mountain bluebirds. We also have been looking closely at the distribution, abundance, and habitat preferences of wading birds, gulls, and terns in Florida and along the North Carolina coast. These studies follow a recently completed look at the status of the great blue heron in New York. We hope to extend our survey of great blue herons to other states as well.

We encourage members of the Laboratory to participate in the Cooperative Research Program. For details, please write to Cooperative Research Program, Laboratory of Ornithology, Sapsucker Woods, Ithaca, N.Y. 14850.

The Canadian Wildlife Service, Ontario Region, is continuing its program of color marking common terns at two colonies in the lower Great Lakes to determine their post-breeding dispersal, migration routes and winter range.

In 1982 bright blue wing tags (with black lettering) were put on adult common terns, and black tags (with yellow lettering) on chicks just prior to fledging. Tags contain number/letter combinations and were placed on both wings of all birds. If you observe a tagged tern, please report the date, location, color of the tag, and number/letter combination to: Banding Office, Canadian Wildlife Service, Headquarters, Ottawa, Ontario, Canada.

Two hundred paintings by Louis Agassiz Fuertes will be displayed during a special exhibition of the artist's work. "A Celebration of Birds: Louis Agassiz Fuertes and his Art" is touring the country and will be at these locations: Feb. 5—April 3, New Britain Museum of Art, New Britain, Conn., April 30—June 26, Field Museum of Natural History, Chicago. The exhibit was prepared under the auspices of the Academy of Natural Sciences, Philadelphia.

1983 is the third summer of data collection for the Ontario Breeding Bird Atlas. Birders visiting the province are invited to participate. Free airplane flights will be arranged for atlas volunteers who will be traveling from northern Ontario to remote areas of boreal forest, muskeg and tundra. To be eligible for these flights you should be an experienced birder with some wilderness survival expertise and at least two weeks to spare in June or July. For more information, contact Mike Cadman, Ontario Breeding Bird Atlas, FON Conservation Center, 355 Lesmill Road, Don Mills, Ontario, M3B 2W8, Canada.

The editors of *The Living Bird Quarterly* invite you to write to us expressing your views on our content or other issues involving birds and the environment.

We reserve the right to edit your letters for style and to use your name unless otherwise requested. Our goal is to establish a forum for your ideas and to address the topics that concern us all.

Dear Member:

We who like birds have a lot to worry about. Loss of wild habitat, continued industrialization, pollution of every description, have reduced the numbers of birds and endangered whole species.

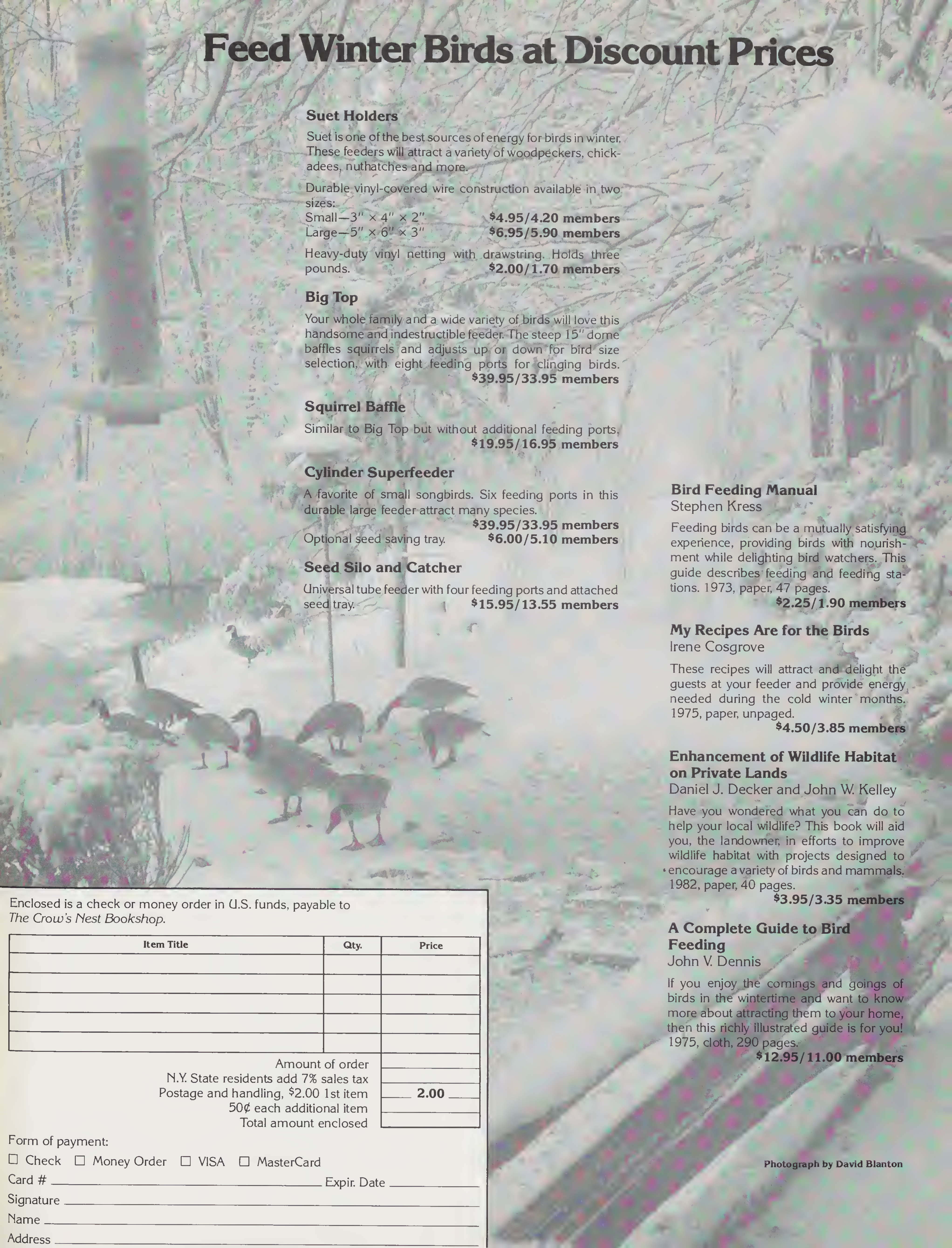
We all are familiar with the ominous forecasts of impending doom. But there is much we can do besides worrying. Note a few of the successes: the reintroduction of the peregrine falcon to the eastern United States, recolonization of Maine islands by puffins, the work of the International Crane Foundation.

Undoubtedly, a great deal more needs to be done, but, instead of dwelling on the disasters, we would like to emphasize in the Quarterly *the positive stories and promising signs around us. Our hope is that, instead of giving up in despair, you will be encouraged to join the effort.*

Ornithology is one of the few remaining sciences where amateurs make significant contributions. Thousands of individuals contribute time and expertise to the annual Christmas Bird Count, and the Breeding Bird Survey of the U.S. Fish and Wildlife Service, bird-banding efforts, and to the Cooperative Research Program based here at the Laboratory. Much of what is known about distributions and abundances of North American birds is the result of efforts by volunteers.

Your participation in programs that foster environmental understanding and preservation is more important now than ever. By working together, we can bring about more success stories, which we hope someday will outnumber the failures.

CHARLES WALCOTT, *Executive Director*



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Osprey

Seatuck: A Haven for Birds

by Linda G. Hooper

"Suburban villas, highway-side retreats,
That dread the encroachment of our growing streets,
Tight boxes, neatly sash'd, and in a blaze
With all a July sun's collected rays,
Delight the citizen, who, gasping there,
Breathes clouds of dust, and calls it country air."
—*William Cowper,* **Victorian Suburb**

William Cowper was describing the disappearance of London countryside when he wrote this mocking verse in 1782. Certainly the trend has continued. Today, in this country, city planners predict a Washington, D.C./New York/Boston megalopolis by the year 2000. This could leave the northeastern seaboard with far fewer of its native plants and animals.

As more and more natural area is converted into highways and shopping centers, wildlife habitat becomes fragmented and homogeneous. Many indigenous birds flee or die, and are replaced by more adaptable species —house sparrows, starlings, and pigeons. However, with the proper planning, birds can live and prosper alongside human development. The Seatuck Research Program, a cooperative effort between Cornell's Laboratory of Ornithology and the U. S. Fish and Wildlife Service, was recently established to study ways to create better habitats for wildlife on the heavily populated south shore of Long Island.

Seatuck National Wildlife Refuge consists of 200 acres of protected woodland, pasture, shrubland, and tidal marsh. When Thomas Litwin, director, and David Peterson, wildlife biologist, began their research in February, 1982, they asked themselves how they could best use this land to benefit the largest number of species.

"The first thing we needed to do," said Litwin, "was to figure out what is on the refuge and what species we want to encourage here. We then have to make it easy for these species to find food and nesting sites. If they reproduce, it increases the likelihood that they will stay."

Litwin explained how he and the Seatuck staff censused the area. "Our biologists went out at dawn once a day during the breeding season, May through July. We first placed metal markers every 164 feet over the 200 acres. On each subsequent trip we stopped at every marker, listened, observed, and wrote down the birds we heard or saw. By the end of the season we had a pretty good idea of what was out there. And what wasn't."

Now that the inhabitants of Seatuck are known, the next task is to manipulate the environment so that species will be attracted to the refuge.

"Land is constantly changing. If Seatuck is left alone, in 100 years it will all be forest. This will eliminate many of the bird species once found in the region because a diversity of plant life supports a greater variety of birds. And as development continues many types of habitat — woodlands, marshes, pastures — are eliminated. If we want to preserve different kinds of birds, Seatuck should become a microcosm of the once larger natural system. To accomplish this, next year we are planning to mow, thin undergrowth, and leave other areas untouched.

"We need to make plants grow, preferably faster and denser than they would normally. We will be experimenting with a technique known as hydroseeding — spraying water and a mixture of aster and goldenrod over three to four acres at one time. We hope to attract eastern meadowlarks and bobolinks which would have otherwise stayed away. Without this procedure it could easily take 10 years for the plants to establish themselves," Litwin said.

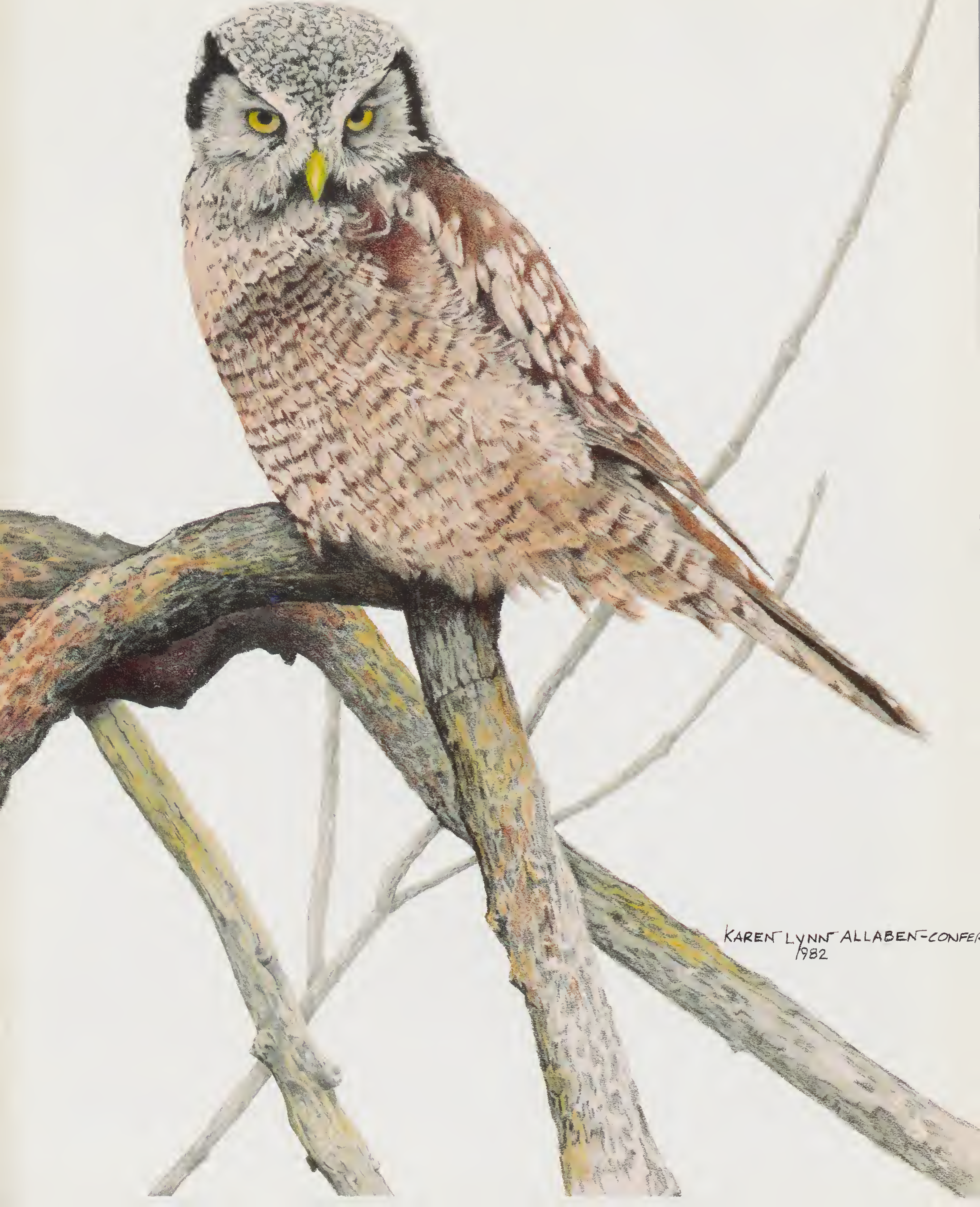
Besides diversification of the land, Litwin is trying to attract birds to Seatuck by creating nesting sites.

"To entice ospreys, we erected nesting platforms on 35-foot poles early in the spring. By mid-June, we were excited to find that a pair of immature ospreys had arrived at the site and had begun frustration nesting. This is a behavior seen in birds that are not mature enough to lay eggs and raise young. These immatures brought sticks back to the nest and exhibited courtship feeding and flight. This may mean actual nesting will take place next year."

In cooperation with the New York State Department of Environmental Conservation, Seatuck is monitoring the populations of colonial nesting birds on the barrier beach from Jones Beach to Fire Island Inlet. Some birds nest where people swim, picnic, and drive dune buggies. As a result, snowy egrets, Louisiana herons, common terns, least terns, and black skimmers are potentially in conflict with these activities.

Litwin explained, "we have concentrated on least terns, since they nest on open beaches which are popular with bathers. The birds would be safer if we could lure them to areas where they don't have to compete with humans. Last summer we cleared vegetation from the part of the refuge that fronts on the beach. We also set out decoys and played recordings of tern sounds. We observed the terns' courtship feeding and nest scraping activities this summer and I'm hopeful that they will breed here next year.

"Of course, all these plans are contingent on one thing—people. If people don't care, all the research in the world won't make any difference."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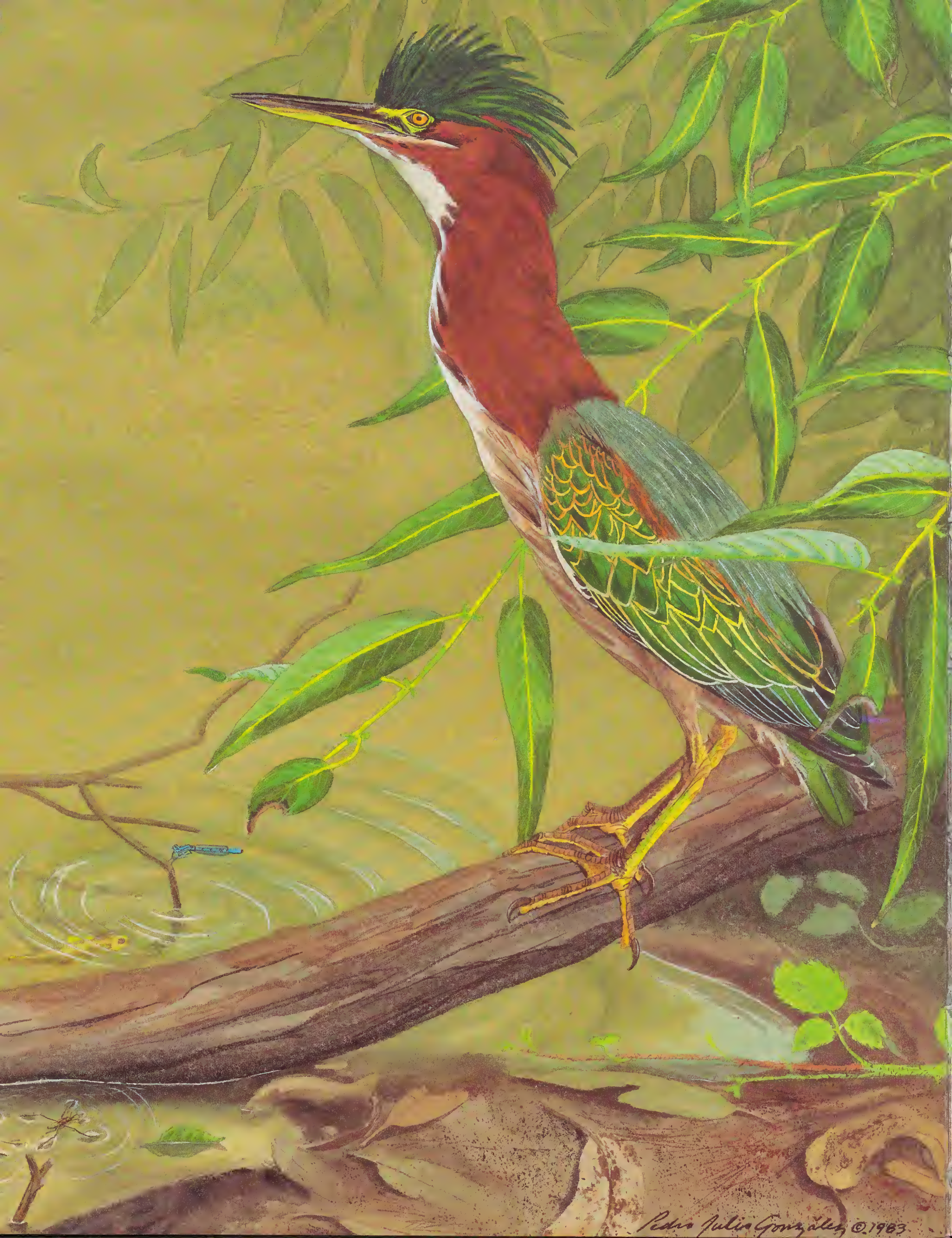
THE LIVING BIRD QUARTERLY

Spring / 1983



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THE LIVING BIRD QUARTERLY

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Volume 2 Number 2

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FRONT COVER. Outside—Eared grebe on nest. Photograph by Tim Fitzharris©. Inside—Green heron by Pedro Gonzales.

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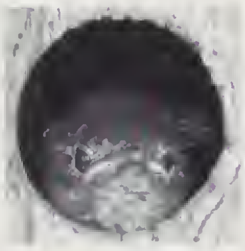
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Sounds We Call Songs

by James L. Gulledge

*In the first of a series of articles on bird communication, examine the complex sounds birds use to communicate then hear them on **The Living Bird Quarterly** soundsheet.*

IN LATE WINTER, March in Ithaca, the hours of daylight begin to increase noticeably. The silence of early morning, characteristic for what seems like a very long time, is now occasionally broken by bird song. The cardinals, black-capped chickadees, and titmice that have been attending bird feeders are preparing for a new season of nest building and rearing of young. Song, a primary means by which birds communicate, signals the imminent change of season.

Although little that we call song has been heard all winter, the birds have not been silent. This is especially true of various flocking species such as chickadees, starlings, crows, and others. However, the sounds they make in winter are different from those that are now beginning to be heard. Where wintertime bird sounds may be harsh and noisy, the sounds that herald spring tend to be musical.

Black-capped chickadees are good examples. Their wintertime flock sounds consist largely of "chickadee-dee-dee" calls. Playback experiments conducted by Stephen Nowicki at Cornell University have shown that the complex "dee-dee-dee" portion of the call allows the birds not only to identify each other individually, but it also allows them to recognize particular flocks.

In late winter and early spring, a quite different sound enters the black-capped chickadee vocabulary. It consists of two or three pure notes, the first higher in pitch. This song will become more and more common as the chickadee winter flocks break up and pairs begin to establish breeding territories.

As winter continues to fade, other species sound forth with their spring and summer songs. The woods begin to fill with migrants passing through to even more northerly regions as well as with the dozens of species that will breed and nest locally. Males will be singing their characteristic songs which in concert make the central New York woodlands resound from May until July. The most dramatic time to hear them is at dawn when every individual joins in an exuberant dawn chorus. Side 1 of the accompanying soundsheet captures a little of such a chorus.

As late spring becomes summer, young fledge, and adults begin to moult, the breeding season concerts diminish. By late summer call notes of various kinds will again make up the majority of avian sounds.

Why Musical Songs?

The avian sounds we call song are of a very specific nature and have quite specific functions in the social biology of the species. These sounds are the functional elements of long-distance communication systems. They are the signals a bird uses to transmit information to other birds over relatively long distances. In fact, we refer to them as "advertising" or "territorial" songs. The spring song of the black-capped chickadee is an example.

In order for a bird to communicate effectively over long distances, its song consists of sounds in which the energy at a given moment is concentrated on a single frequency. What we hear are the pure whistled tones typical of so much bird song. Since we find the acoustically similar sounds of flutes and related instruments musically pleasing, we like to think of bird song as musical.

Studies by Robert Bowman of San Francisco State University have shown that the range of frequencies used by a particular species—indeed, by different populations within a species—are those that transmit best in the birds' habitats.

©Ron Austing

Yellow-headed blackbird sings from cattail. Camera catches song of Henslow's sparrow.
]

Gary Meszaros

A mockingbird's identity is seldom in doubt even when it sings a replica of another bird's song.

Figure 1 illustrates this for different populations of the large cactus finch, *Geospiza conirostris,* which lives on Isla Española and Isla Genovesa in the Galápagos archipelago, each with slightly different habitats. The contour-like lines reflect the degree to which various frequencies are absorbed by the habitat. The further the lines are shifted to the right, the greater the absorption of the respective sound frequency. To the left of the sound absorption curves are histograms of the amount of sound energy found at each frequency, measured in samples of songs from the respective populations.

On average, the birds put more energy into sounds at frequencies that are least absorbed by the habitat in which they are singing.

To Make a Bird Song

The vocal sounds birds make are produced by a special structure known as the syrinx. Whereas the larynx (figure 2), the sound-producing structure of mammals, is found at the upper end of the trachea, the syrinx of birds is found at the lower end where it splits into the two bronchi which lead to the lungs. Here the normally soft supporting elements of the tracheal and bronchial tubes have become rigid and form a cartilaginous box.

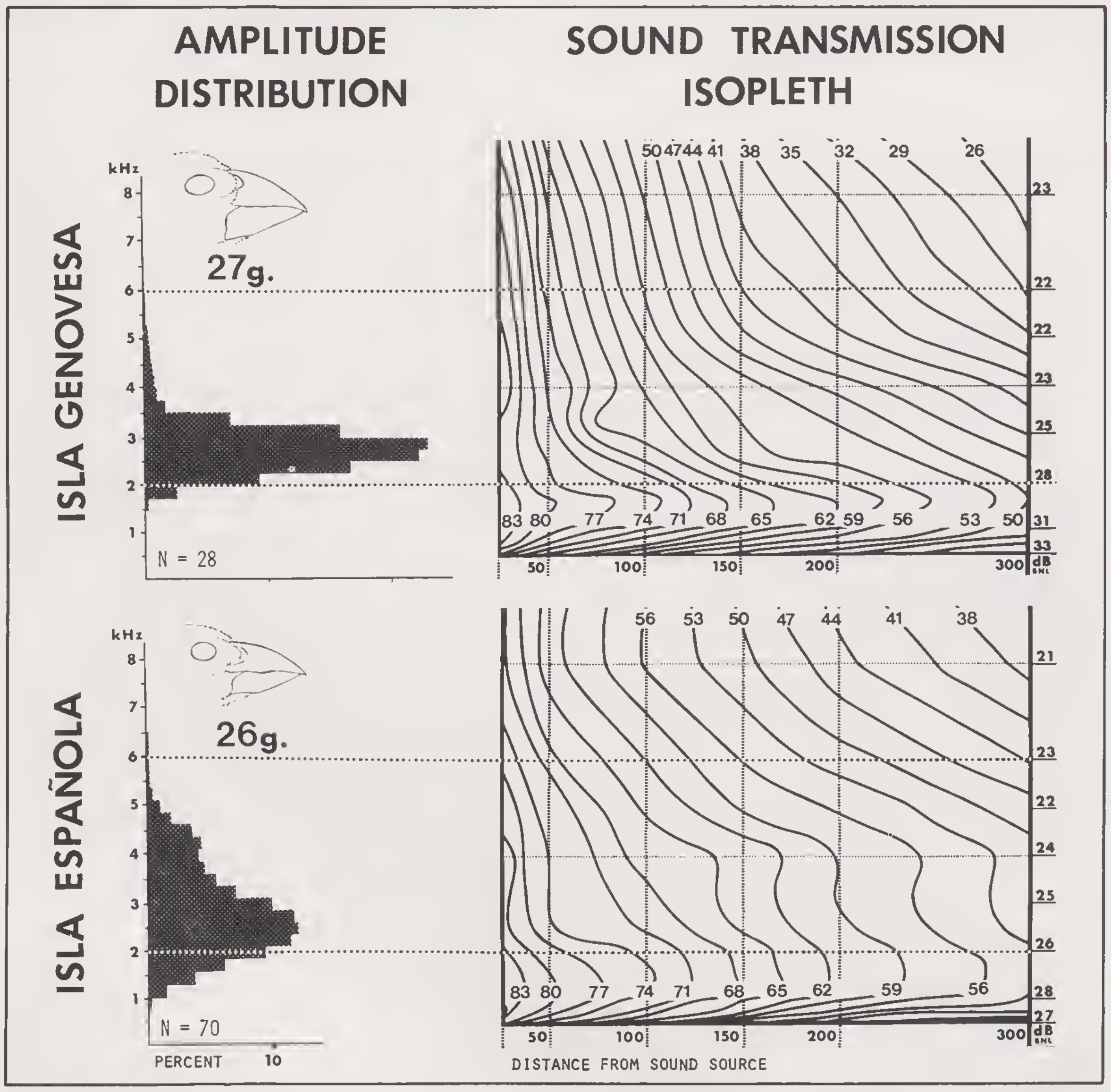

Figure 1

Courtesy Robert I. Bowman

Inside the syrinx are several structures and membranes. The most important in the generation of sound are the two internal tympaniform membranes located in the anterior end of each bronchial tube. When these membranes are stretched, the passage of air over their surfaces causes them to vibrate. The vibrations are transferred to the moving air, thus producing sound.

Surrounding the syrinx is a complex system of muscles. These muscles allow the bird to control precisely the tension on the two internal tympaniform membranes thereby changing the rate at which they vibrate. Since the rate of vibration determines the frequency (pitch) of the sounds produced, the bird can control the tonal range within which it sings.

Complexity

Since many birds of many species are often singing at once, broadcasting pure tones—even of different pitches—would not allow species and individuals to recognize one another. Effective communication would not be possible. Somehow the "information content" of the signals must be increased. This can be done by increasing the complexity of the sounds and their patterns.

A bird has several means at its disposal to achieve complexity in its sounds and songs. At the most fundamental level the bird can impose patterns of shifting frequency and amplitude of each note. Next, different combinations of notes can be organized into phrases. Finally, phrases can be organized into songs.

Making bird song potentially more complicated is a bird's capacity to set tension independently on the two internal tympaniform membranes resulting in two simultaneous but different tones The two tones do not even have to be harmonically related, explaining why some bird sounds are dissonant.

By carrying out detailed analyses of the sounds made by many species, Crawford Greenewalt documented in *Bird Song: Acoustics and Physiology* that birds can and do use both of their sound generators during the course of vocalizing. Examples of the results of these

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Side 1

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A May Morning in Central New York

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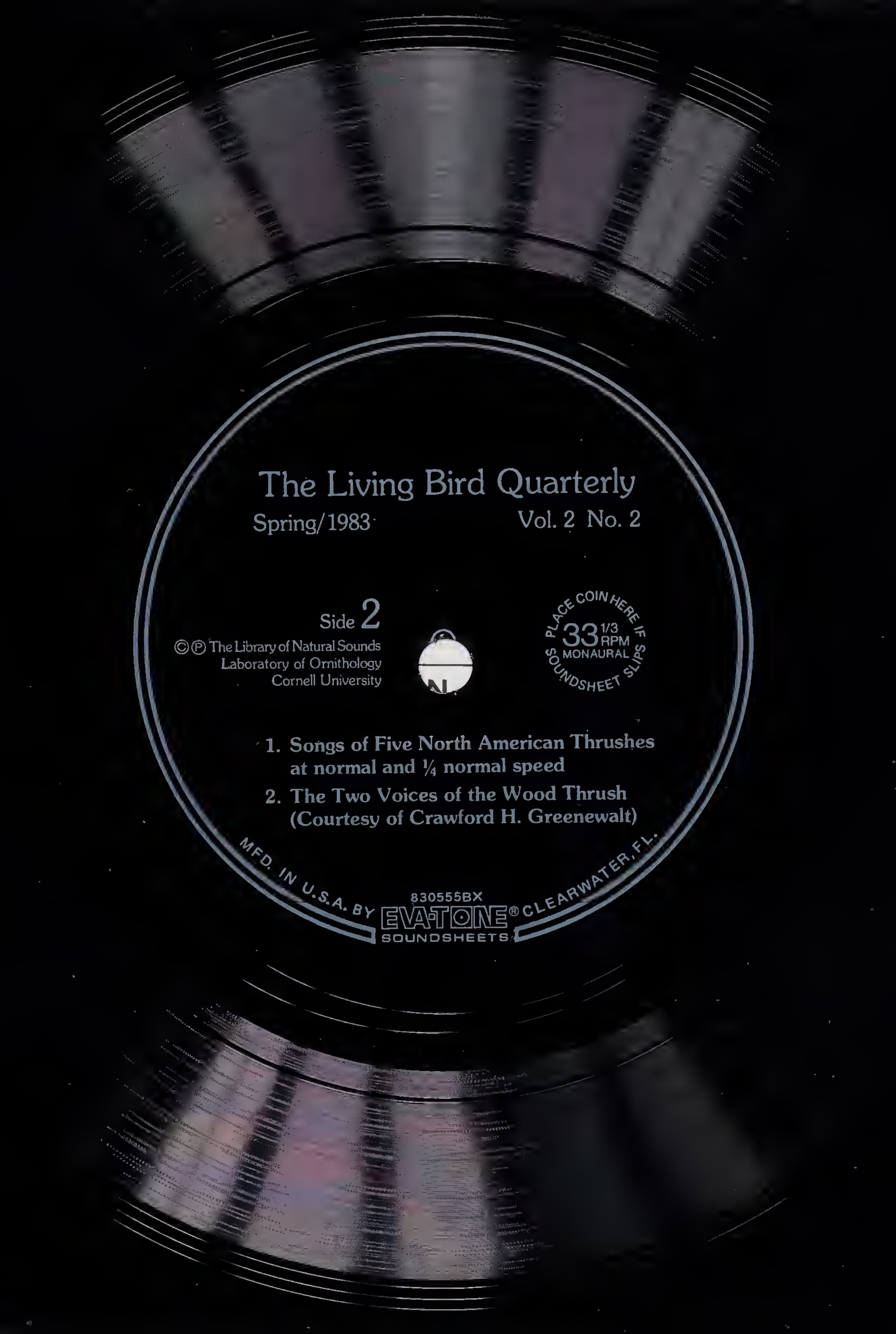

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Spring/1983

Vol. 2 No. 2

Side 2

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PLACE COIN HERE IF SOUNDSHEET SLIPS
33 1/3 RPM
MONAURAL

1. Songs of Five North American Thrushes at normal and ¼ normal speed
2. The Two Voices of the Wood Thrush (Courtesy of Crawford H. Greenewalt)

MFD. IN U.S.A. BY EVA-TONE® SOUNDSHEETS CLEARWATER, FL.
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Laura Riley (Bruce Coleman Inc.)

A bird not only sings, it squawks, calls and, like this blue jay chick, begs for food.

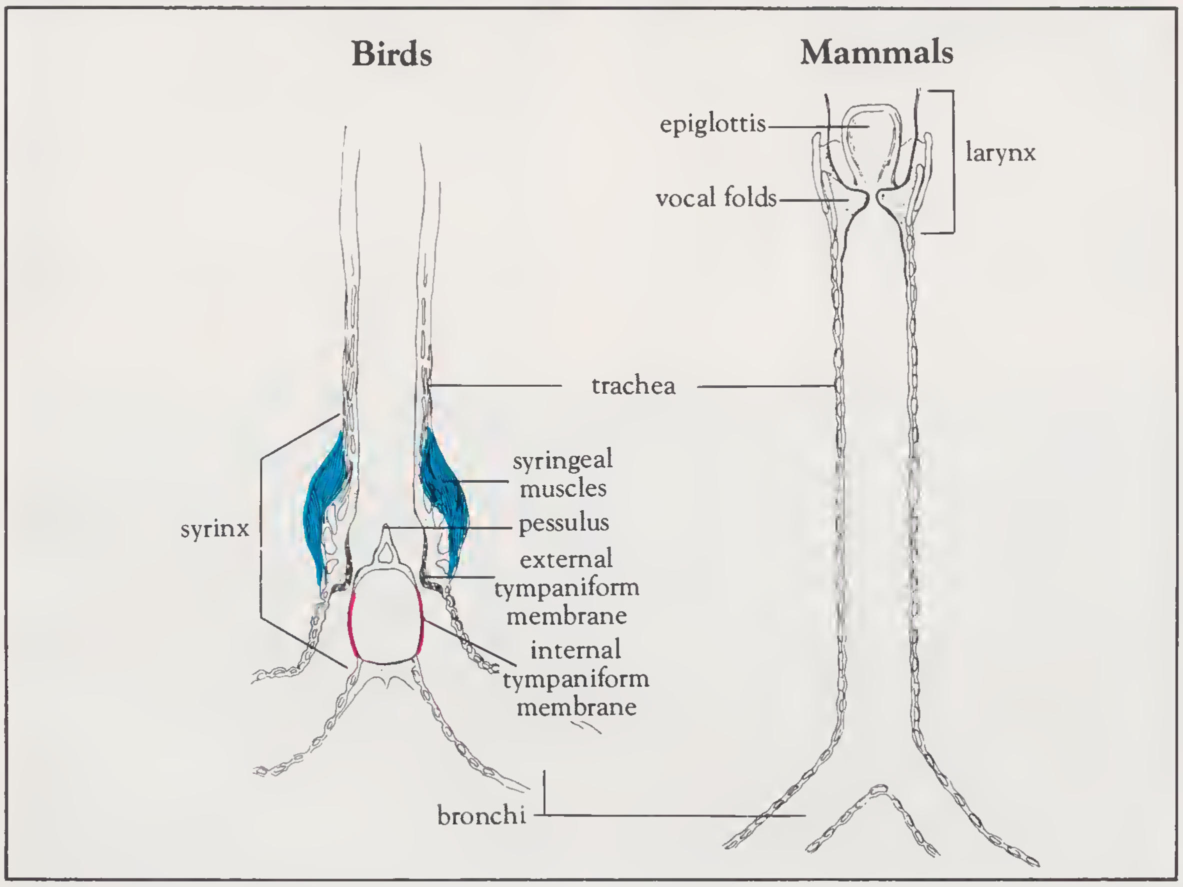


Figure 2

studies are illustrated on side 2, band 2 of the accompanying soundsheet.

Patterns are imposed on the pure tones generated by the internal tympaniform membranes by controlling two aspects of sound — frequency (pitch) and amplitude (loudness). The imposition of frequency patterns onto a pure tone is called frequency modulation. This is what a musician, either singer or instrumentalist, does with vibrato. The basic tone is shifted ever so slightly up and down. To our ears the most pleasing rate for this is about 10 to 12 times per second.

In imposing frequency modulation patterns onto the basic pitch of their songs, birds use rates ranging from less than one time per second to more than 200 times per second. If the change is slow and over a relatively large range of frequencies, we hear a glissando as in the slurred notes of the cardinal. If the change is rapid, we can no longer hear the pattern of change itself. Instead we hear a buzzy sound at the basic pitch of the bird's song. The song of the golden-winged warbler is a good example.

The most complex patterns of frequency modulation are produced by songbirds. To accomplish this, these birds have the most complex system of syringeal muscles of all birds. They don't always use their capabilities, however. For example, the structural elements found in the syrinx of the white-throated sparrow and wood thrush are the same. But the white-throated sparrow sings simple songs of a few pure tones whereas the wood thrush is renowned for the complexity of its songs.

Changes in amplitude also can be imposed on the basic tone. A simple way to demonstrate amplitude modula-

About the Soundsheet

Side 1

The first side of the soundsheet included in this issue of *The Living Bird Quarterly* was recorded one May morning in central New York. See if you can identify the singers; some are listed here in taxonomic order.

wood duck (flight call)
mourning dove
great crested flycatcher
American crow
house wren
gray catbird
American robin
wood thrush
veery
red-eyed vireo
common yellowthroat
Canada warbler
northern oriole
brown-headed cowbird
scarlet tanager
rose-breasted grosbeak
rufous-sided towhee
chipping sparrow
white-throated sparrow
red squirrel

Side 2, Band 1

In this selection you will hear five North American thrushes: wood thrush, veery, hermit thrush, gray-cheeked thrush, and Swainson's thrush. First, you will hear the songs at normal speed. Then you will hear them repeated at one-quarter speed. The complexity of the thrushes' songs is particularly discernible when they are slowed down. Also, you can hear the two independent sound sources, clearly apparent in dissonant portions of the songs.

Side 2, Band 2

In this selection you will hear the terminal phrases from two wood thrushes; first at normal speed, then slowed to one-eighth normal speed, then filtered to emphasize the low voice, then filtered to emphasize the high voice. Finally, you will hear both voices again, at one-eighth speed.

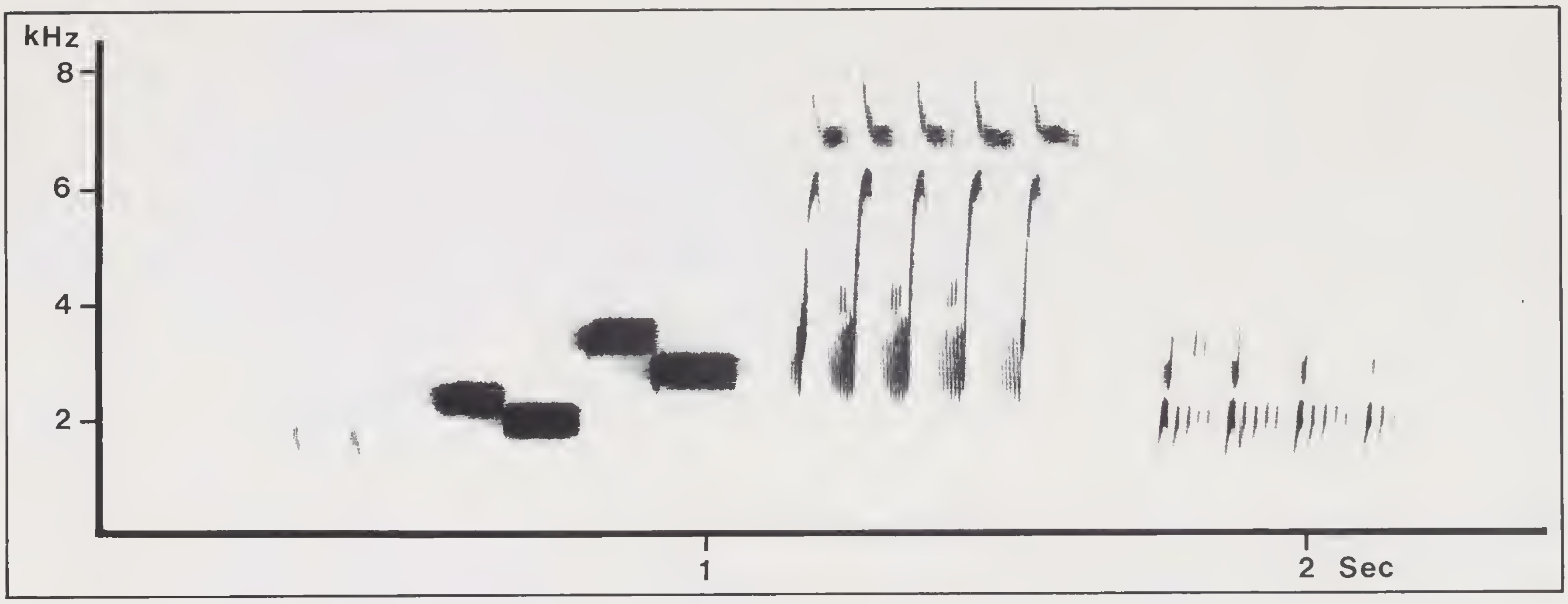


Figure 3. *A spectrogram is a picture of sound. This one is the first wood thrush song heard on side 2, band 1 of the accompanying soundsheet.*

tion is to rhythmically turn the loudness control on a radio up and down. An example of a bird song in which amplitude variation is the primary means of imposing pattern on the basic tone is the tremulous "whinny" call of the screech owl.

Research with doves, carried on at Ohio State University by Abbot and Sandra Gaunt suggests that amplitude modulation in avian sounds is accomplished primarily by the action of abdominal muscles acting to impose rhythmic contractions on the air-filled cavities in which the syrinx and lungs lie. This causes small changes in the rate of air flow over the vibrating membranes in the syrinx. These small changes are reflected as variations in loudness of the tone.

By simultaneously changing the pitch and loudness of the fundamental frequencies being produced by their two tympaniform membranes, birds are able to create a nearly limitless variety of different notes.

However, even these sources of variation seem not to be enough. The individual notes are assembled into phrases and the phrases into songs. At each level there is room for variety in the way the individual notes are grouped. Usually a given species will have characteristic patterns of repetition for the components of the phrases and for the phrases of songs.

The species-specific nature of such large-scale organization is clear when we hear a northern mockingbird imitating the song of another species. Although the mockingbird may sing a nearly identical replica of components of another bird's song, there is seldom any doubt as to the real identity of the singer because the mimicked songs are not organized properly. The mockingbird puts them together in its fashion, not in that of the species it is mimicking.

Thrushes, for Example

Some of the complexities of richly structured bird songs can be best appreciated when they are slowed down. This has been done on the accompanying soundsheet for five species of North American thrushes.

The sound spectrogram is one of the most useful tools for studying bird song. It is a diagrammatic "picture" of sound. Figure 3 is an audiospectrogram (Sonagram) of the first wood thrush song heard on side 2, band 1 of the soundsheet. Think of it as a musical staff on which the notes are diagrammed rather than represented by musical symbols. Loudness is represented by the darkness of the diagram at a given point. High-pitched tones are at the top. The range of tones is from about two octaves below to four octaves above a piano's middle C. Time increases along the horizontal axis from left to right.

After several introductory notes, the first phrase of the wood thrush's song typically consists of several pure whistled tones, each held steady with little or no frequency or amplitude patterning. The next phrase is more complex and in the song illustrated here the bird's two voices are alternating on two notes. The final section of the song is equally complex and is best heard rather than described.

It seems likely that the sections of the wood thrush's song are structured to communicate different information over different distances. The long pure tones of the first phrase are typical long-distance signals. If one is relatively far from the bird, these and a bit of the second phrase are all that is heard clearly. The last phrase at any distance at all is practically inaudible. This complex phrase seems more likely to be used in close-range communication with neighbors or mate. Only if one is relatively close to the singing bird can the details of this complex froth of notes be distinguished.

Bird song, then, is more than a collection of aesthetically pleasing sounds that we enjoy each spring. It is a fundamentally important means by which birds transmit information to one another. The songs we hear are the result of particular breeding season social systems and the kinds of habitats in which birds live. The characteristics of the songs of each species have been molded by the need to communicate different kinds and amounts of information over different distances in different habitats. Fortunately for us, the sounds that serve songbirds best in spring have characteristics that we find most pleasing to the ear.

FURTHER READING

Jellis, R. *Bird Sounds and Their Meaning.* British Broadcasting Corp., London. 1978.

THE AUTHOR

James Gulledge is director and curator of the Laboratory's Library of Natural Sounds.

A Bird Sanctuary in Perpetuity

by Sally Hoyt Spofford

LAST SUMMER I WALKED into the Laboratory of Ornithology's Stuart Observatory as I do once each year when I return east from Arizona. As I stood in the foyer, its walls covered with original paintings, the large observatory windows looking out over the sanctuary pond, my thoughts flashed back to that December day in 1956 when Arthur A. Allen, co-founder of the Laboratory with Peter Paul Kellogg, moved his office from Fernow Hall on the Cornell University campus into the new unnamed building. As Dr. Allen's assistant, and bookkeeper for the Cornell Trust for Ornithology which funded the Laboratory, I was moving too. The building, though barely furnished, was beautiful. Today it is even lovelier and certainly in December of '56 no one could have dreamed of the changes that would take place over the next 25 years.

In June, 1955 the Laboratory only recently had been recognized by the University as a separate administrative unit attached to no particular college and responsible directly to the president. It had been associated with several other university departments since its founding in 1915. At last it had its own building and staff and Sapsucker Woods as a permanent sanctuary. Much of this had been made possible by the Lyman K. Stuart family, Arcadia Foundation, and many generous contributions.

Allen and Kellogg were co-directors. William C. Dilger was the R. T. French Professor of Ornithology and assistant director in charge of research. Shortly thereafter he began directing graduate research. Bill had already moved into the building so that he could properly care for his African lovebirds which had been housed in his garage for several months. Byrl Kellogg as volunteer sound librarian, Elsa Allen as volunteer librarian, David Allen as refuge manager, and I completed the staff.

On May 18, 1957 the building was dedicated, though still unnamed. Invitations were sent to ornithology alumni, friends of the Laboratory, distinguished ornithologists, institutions and bird clubs. The days before the big event were filled with activity for the staff—setting up exhibits, cleaning and polishing, arranging for parking, (cars lined the road for a mile on May 18) and preparing food for the reception. After the dedication ceremony, small groups toured the sanctuary. In the

Sapsucker Woods

evening, Crawford Greenewalt showed ultra high-speed films of hummingbirds.

One of the first special events held in the building was a meeting of the executive committee of the Cornell Board of Trustees. We were all nervous about the scrutiny we knew would be given the new facility, and my favorite memory is of Elsa Allen discovering, just as the group arrived, that the stainless steel water fountain looked spotty. She hastily poured about half a bottle of detergent on it, scoured quickly, and went off to greet the guests. Shortly thereafter I was summoned by the chairman of the executive committee. He pointed to the mountain of suds emerging from the fountain and pouring all over the floor. "Is it rabid?" he asked.

It is hard to believe now that the Brewster wing, housing Frederick Brewster's study and the Louis Agassiz Fuertes paintings, has not always been there. In 1958 Cornell received word of the bequest by Mr. Brewster of the paneled study in his home in New Haven, Connecticut, which housed murals done by Fuertes. Final note of the bequest came after the death of Mrs. Brewster; ground was broken and construction began in 1967.

When all the building materials were piled on the front lawn we were surprised to discover that a mallard had chosen a protected area under a pile of boards to lay her eggs. Workmen, staff, and visitors kept close tabs, and someone erected a sign: "Nursery, Quiet Please." When the boards had to be used in the construction work, the workmen erected a small A-frame over the nest. The eggs hatched and the ducklings were safely led around the building to the pond.

Through gifts the Laboratory was constantly adding to its collection of Fuertes's art. In the fall of 1959, a particularly fine collection came from the estate of Dr. Donald Guthrie, then head of the Guthrie Clinic in Sayre, Pennsylvania and a good friend of Paul Kellogg. It included a mural of a peregrine stooping for a pheasant. An attempt was made to acquire a copy of every publication Fuertes had illustrated. There were gifts of scraps of paper, even napkins, on which Fuertes had made sketches for friends, or to illustrate a point. I remember a lovely shelf fungus in the collection which shows a sketch of a skunk.

What is now Sapsucker Woods Sanctuary was first noted as a fine birding area in the early 1900s by Doc Allen and Fuertes, among others. In 1909 they, along with friends James Gutsell and Francis Harper, found a yellow-bellied sapsucker nesting in the cool, damp woodlot—the only nesting spot then known in that part of New York State. After that, they referred to this woodlot as "the Sapsucker Woods," and the name stuck. University classes in zoology went there for field trips, and several graduate theses were based on studies in the woods.

Housing began to creep up in all directions and the woodlot became threatened, not just by encroaching development, but by lumbering. Rescue came at the last moment when Lyman Stuart purchased various sections amounting to about 110 acres and gave them to the University to be a sanctuary "in perpetuity." The University added about 20 acres, the Walter Heasleys deeded their 20 acres, and Art Lane, who lived adjacent to the woods, gave his remaining acres.

> *"I remember the question: 'When the birds fly through Ithaca are they coming or going?'"*

The pond was dug before the foundation for the building was laid, and I remember that in August of 1954, the Federation of New York State Bird Clubs had a field trip, led by Allen and Kellogg, to inspect the hole in the ground. In October, 1955 there was a small amount of water for the first time. The dike caused some problems, or rather muskrats burrowing into it did. We had a critical time at one point when we found the pond slowly draining through a large hole into the adjoining field.

The sanctuary was fenced in 1955–56, and then came the work of laying trails. Since I was familiar with the woods, I was invited to work with the Allens and the Stuarts in determining the layout. Doc knew the places he wanted to include, and we followed along behind him as he put up white rags (we all donated old sheets) for the bulldozers to follow. That summer was a dry one, and the next year we found portions of the trails under water; so began the placing of catwalks over the wettest spots.

After a seven-ton boulder with the sanctuary plaque was brought in by flatbed truck, and wildflowers, ferns and hemlock trees had been planted, the sanctuary was dedicated on June 10, 1956 before an appreciative audience.

In the mid-50s, the co-directors decided we should have a membership, entirely honorary, to be kept informed of our activities. The first invitations were sent to alumni, friends, and ornithologists around the country. The names of those who accepted the invitation were presented to the president of the University who, along with the co-directors, signed the membership cards. Many of these members still treasure those first cards. When in the early '60s it was decided to have a dues-paying category to help support the Laboratory, the honorary members were assured that no dues were required from them, but that it was hoped that they would wish to become paying members.

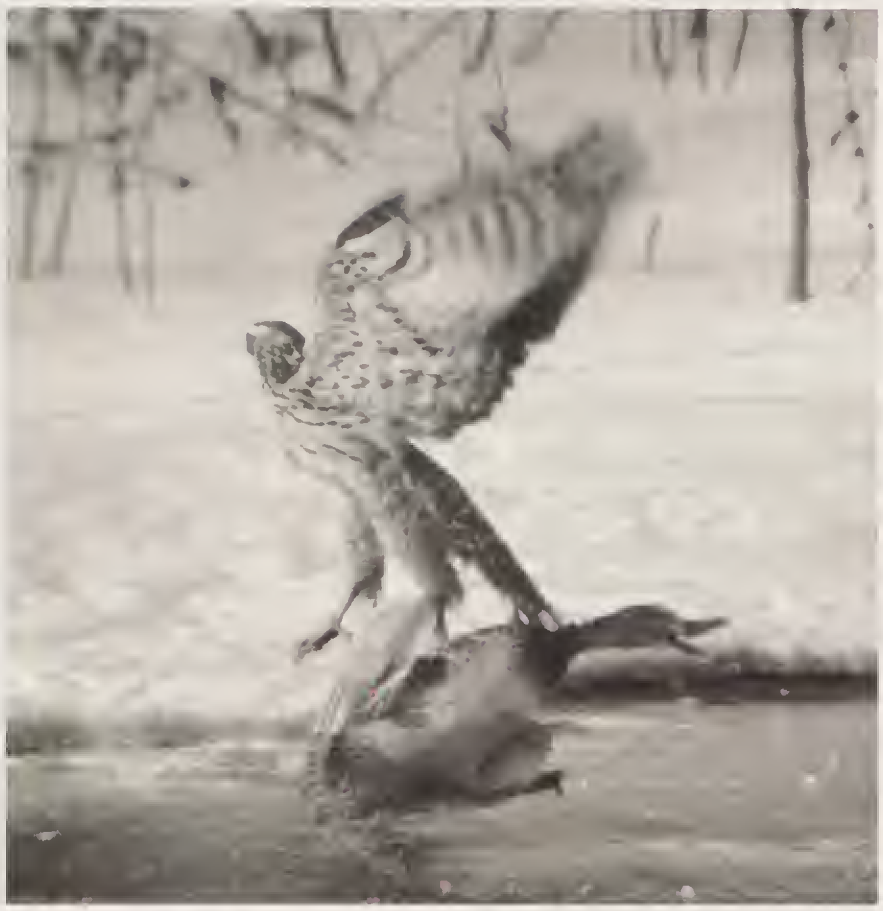
In June of 1956, the first laboratory newsletter was sent out to its members. The early numbers make fascinating reading now—with Dr. Allen's chatty reports of what was going on in the sanctuary and with staff members, announcements of events, and homespun pleas for gifts. Dr. Kellogg contributed news of sound-recording activities and additions to the Library of Natural Sounds.

At a board meeting around 1960 the idea of an annual publication was first discussed. Roger Tory Peterson, on the board at the time, was anxious for a journal which would appeal to a lay audience as well as professional ornithologists. It was he who proposed the name *The Living Bird.* It turned out to be a very successful journal and early issues are now collector's items.

Shortly after the building opened, an article about it appeared in *Audubon* magazine, written by Professor Richard B. Fischer of Cornell. It brought more visitors to the Laboratory. However, a real increase in numbers came following the publication of an article by Dr. Allen in *National Geographic* in April,

Richard B. Fischer

Above: *David and Doc Allen placed catwalks over the wetter parts of the trails.* **Right and below:** *Mallard dubbed Mrs. Twitchell developed a nervous disorder after this brush with a goshawk, however, she did appear one day in June with a large brood of ducklings.*



Arthur A. Allen Papers. Cornell University Libraries, Manuscripts and Archives

1962 entitled "Cornell University's Exciting New Bird Sanctuary," illustrated mainly by his own photographs. There was mention of the bird song recordings, and the fact that a catalogue was available. Descriptions and prices were given, and we could not believe the flood of mail that began arriving. We filled about 1,000 orders the first month following publication, compared with the usual 30 to 50.

Publication by the Laboratory of the booklet "Enjoying Birds in Upstate New York" added some income; a review by John Brown in a Rochester newspaper brought 90 orders in a few days. In 1962 the first sets of postcards "Birds of Sapsucker Woods," were marketed, and the second set, gamebirds by Louis Fuertes, made a great hit.

With our popularity came new tasks. One summer the Burpee Seed Company financed the purchase of a mynah bird, to be trained by the Laboratory to speak Burpee's slogan, and to greet visitors with: "Hello, hello, Burpee seeds grow." We trained it with a tape recording, and after Dr. Allen became bored with the tape and the bird in his office, he put them in the graduate students' office. It was remarked later that while the bird was fairly slow in learning its lessons, some graduate students could certainly tell everyone that "Burpee seeds grow." As a surprise bonus, the bird learned to whistle the first bars of "Far above Cayuga's Waters."

Later, I brought to the Laboratory a mynah which had learned several interesting phrases. It managed to give a scare to the university patrolman who checked the observatory the first night the mynah was there. Who would possibly greet the Safety Patrol with "Hi Sweetie!"?

Another attraction for visitors was Dr. Allen's photographs. Some featured a recent trip, but often they were of events in the sanctuary. Doc's titles under the pictures were classics. A favorite concerned the covey of bobwhite quail which had been released at the sanctuary with the hope that the birds would take hold and increase. (Bobwhite had vanished from Tompkins County some years earlier.) I remember one morning when he came in, a quiet smile on his face and a piece of toast in his hand. "You've heard of quail on toast, haven't you?" was his query. Out on the feeder went the toast, and in no time Doc had his picture "Quail on Toast."

We were very proud that we were on the area list of interesting places, but we had a slight setback when a woman remarked: "This is where we bring our houseguests when we don't want to spend any money on them."

Monday Night Seminars, part of the Laboratory since its beginning, were not only free but educational. After the Brewster wing was complete they were held in the Fuertes room. In the first years we often had problems getting speakers, and relied mostly on staff, faculty in related departments, graduate students, out-of-town visitors, and films from our library. In recent years, however, there has been no problem filling the program.

Visitors to the Laboratory also could enjoy watching the waterfowl on the pond, especially at feeding time. In the first few years after the pond filled, the wintering wild ducks that joined the captive ducks and geese numbered fewer than 100, but then word got out and many of the dabbling ducks that wintered on Cayuga Lake flew into the pond in the morning, remained for the two daily handouts, and departed for the lake near sunset. By the early '60s we estimated about 1,000 ducks a day in winter.

In the earlier years we had species other than the resident mallards and blacks: pintails, wigeons, teals, shovelers, redheads, canvasbacks and others, including a redhead-shoveler hybrid that wanted to come out on land to feed, but constantly fell forward be-

Three photos by Sally H. Spofford

Twice a day Doc Allen took a bucket of corn outside and scattered it for the waterfowl which swarmed toward him. For a few years Stevie, a one-winged whistling swan, was a familiar sight on the sanctuary pond.

cause of the position of its legs on the long shoveler-type body.

For a few years a familiar sight on the pond was Stevie, the one-winged whistling swan which had been brought to us by graduate student Steve Eaton. Twice we tried to acquire a mate for Stevie, but without success. In fact, the first one, shipped by train from Philadelphia, escaped from its cage in a station en route, was hit by a taxi and eaten by the driver who called it “the toughest goose I ever ate.”

Another famous resident of the pond was a trumpeter swan. The day it was delivered, the shipping crate was placed outside the observatory window near the water. Fred Truslow, a friend of the Laboratory well known for his *National Geographic* articles, was there at the time. Although Fred was busy with his camera, he helped unload the swan. Huge bird that it was, it objected to being man-handled and struck out at the closest target—Fred. Fred, forgetting the outside microphones which brought bird songs into the observatory, expressed his pain and indignation in no uncertain terms—to the amusement of those hearing him inside.

We were always getting calls to care for some specimen, injured or ill. One of the strangest patients was a peacock from the local zoo. The bird, against advice, had been left in an outside pen during a cold snap, and was found in the morning, seemingly frozen to death. It was brought to the observatory where Bill Dilger detected a pulse. I remember Bill and two or three staff members on their knees in the front lobby, the peacock wrapped in warm towels, Bill giving it artificial respiration. For the next few days he labored over it, and was rewarded when the peacock was finally strutting around his aviary, in fine fettle.

I was the staff member who fielded questions over the counter or by phone or mail. I kept a written record of some of the questions, comments, and conversations overheard, and mimeographed it for the amusement of future question takers. It is entitled, “The Lighter Side of Working at the Front Desk.” I remember the question: “When birds fly through Ithaca are they coming or going?” When the record of Sapsucker Woods bird songs was being played in the observatory, I overheard, “I wonder how they get the birds to fly by the window in that order.” And one winter: “How do you get the pond to freeze like that?”

With Dr. Allen’s sharp eyes, and bird watchers in the observatory most of the day, it was natural that rarities were seen, such as the area’s first western kingbird. A goshawk took up residence one cold week, perching at the edge of the woods beside the pond. The waterfowl were concentrated in a small patch on the bank when the goshawk made his plunge into their midst. They headed for the water, but the big accipiter managed to grab one female mallard. She struggled hard, succeeded in loosening the bird’s grasp, and escaped, but with obvious injuries. After that we could always recognize her; her wing dragged and an injury to her nervous system made her constantly shake and shrug. Doc named her Mrs. Twitchell, and we were pleased to find that she was not unattractive to the drakes, for she appeared one day in June with a large brood of ducklings.

The death of Arthur Allen in January, 1964 was followed in a few months by that of his friend and laboratory benefactor Lyman K. Stuart. In May of 1965, the observatory was fittingly named the Lyman K. Stuart Observatory at a dedication service in front of the building.

Funds were contributed by many people for a memorial to Arthur A. Allen, and the board decided that one appropriate way to honor his memory was by giving an Allen award each year to someone who had made a significant contribution to the popularization of ornithology. The first recipient, in 1967, was Roger Tory Peterson. Fourteen of these awards have now been given.

My reminiscences could go on much longer. Perhaps they serve to show a few of the changes that have taken place over the years. The early, intimate atmosphere is gone, but today the Laboratory has won worldwide recognition for its programs, and has many new, exciting ones as well, all of which promise to make the next 25 years dynamic and meaningful.

FURTHER READING

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THE AUTHOR

Sally Spofford retired from the Laboratory in 1969 and now lives in Arizona.

Why Share a Mate?

by John Faaborg

The Galápagos hawk is one of only three species known to practice the breeding behavior of cooperative polyandry.

Tui A. DeRoy Moore (Bruce Coleman Inc.)

Above: *Galápagos hawk looks out over volcanic crater on the island of Fernandina.*

Right: *John Faaborg, with Galápagos hawk captured at campsite at Sullivan, Santiago.*

ONE CANNOT MENTION the Galápagos Islands without thinking of Charles Darwin and the theory of evolution, so integral are they to his ideas. Thus it was with trepidation that I approached these tropical islands with a question that seemed to challenge Darwin's evolutionary tenets.

My students and I went to the birthplace of evolution to study cooperative polyandry, a mating system which occurs in the Galápagos hawk, *Buteo galapagoensis.* Ninety percent of all bird species practice monogamy, one male and one female mate and raise a brood of young. In the Galápagos hawk, two to four males mate with one female, and together they raise the offspring.

Evolution is in many ways a selfish system. It favors individuals that look out for themselves, adapt to their environment, and contribute genes to future generations. This being the case, why should a male Galápagos hawk share his mate with three other males, thereby reducing his chances of contributing to the gene pool to a fraction of what it might be if he were monogamous?

Before setting out for the Galápagos to answer this question, we searched the literature for clues that might explain cooperative polyandry. We found that only two other bird species show this behavior. One is Harris' hawk, *Parabuteo unicinctus,* a wide-ranging raptor that uses this mating system in Arizona and New Mexico; the other is the Tasmanian native hen, *Tribonyx mortierii,* a coot-like forest dweller of that island. Trios of two males and a female occur regularly in these species, but no good explanation for them has been offered.

The fact that only three out of nearly 9,000 bird species in the world are known to practice cooperative polyandry suggests that unusual conditions must be present for it to occur. We left for the Galápagos assuming that we would find these conditions and that evolution was hard at work. We had to admit, though, that it was not obvious why cooperative polyandry was a better system than monogamy for the Galápagos hawk.

Once we arrived in the Galápagos we temporarily forgot about theories and focused on day-to-day existence. We coordinated our activities at the Charles Darwin Research Station (CDRS) on Isla Santa Cruz. This international facility was immeasurably useful in arranging logistics and in helping us with the necessities. For one thing, the islands have little fresh water, and just hauling drinking water was a major chore made easier by the CDRS.

After surviving the long ocean voyage we tried to adjust to the distinctive quality of the islands. The tameness of Galápagos animals, for example, is quaint when it means a Darwin's finch landing on your plate to peck at your pancake, a lava lizard climbing up your pantleg, or a snake gliding across your boot. It's not even bad when the native rice rats, with their Mickey Mouse ears, peek out from the bushes at dusk. But when they swarm into your tent and gnaw the backpacks, it's not cute anymore. Almost compensating for this were the short-eared owls that were attracted to our camp by the rats. In addition to aerial attacks, these tame predators would chase the rats on foot under the bushes. With the owls, the rats, and the incessant barking of sea lions, camping on the Galápagos was definitely different.

Walking on the Galápagos Islands was also an adventure. Besides the

Curt Griffin

BHL

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giant cacti and vast stretches of dry scrub, I was intrigued by the old craters and cones and the more recent lava flows. At our Sullivan Bay, Santiago campsite, some of these flows stretched for miles, capturing the feel of sea swells in hard, black rock decorated with swirls like chocolate pudding. Usually the lava was easy walking, but in some spots it was cracked and splintered and tore boots to shreds.

Our field work concentrated on observing the behavior of adults at the nest, recording nest success, and banding and color marking. By banding the territorial adults we found that they stayed on the same territory from year to year. We banded nestlings and fledglings for information about the mortality of the young birds and to see if they returned home in later life. Finally, we banded birds that did not appear to be attached to any area to see how many there were and how they moved into the breeding population.

Our field studies were aided by the tameness of the hawks. This is not to say they did not defend their nests with a vengeance. Having been clobbered on the head, I can personally attest to their seriousness. Getting caught in the open by three or four male hawks always provided a fearful moment for the victim and a few laughs for the spectators. Fortunately, these attacks did not last long and if we sat quietly near the nest, the hawks soon would settle down.

Outside of polyandry, the Galápagos hawk is much like any other hawk. It takes about three years for the buff-colored immature to attain the dark adult plumage. The birds use standard *Buteo* techniques to catch live animals on the islands, and they scavenge both natural (sea lion placentae) and introduced (goat and pig) foods. As in most hawks, the female is larger than the male and monopolizes incubation, feeding, and brooding the young. She usually lays two eggs. Both the incubation period (38–40 days) and the fledging period (50–60 days) are similar to other hawks. The fledgling is chased out of the territory two to three months after leaving the nest.

The big difference between this and other hawks is that a group of males fills

John Faaborg

Right: *This nestling stands on its nest which is simply placed on lava.* **Below:** *Galápagos hawks hunt using standard* Buteo *techniques.*

Robert I. Bowman

in where one usually suffices. No one watching groups of males has seen one male dominate the rest. Instead the males are equals and share in copulating with the female, defending the territory, incubating, and feeding the young. Only one male fathers each offspring, but we know of no way the males know which of them is the father.

We expected the territory to be defended all year, but we were surprised to find that once a group of males has taken possession of a territory, no new group members are added during the lifetimes of those males. Rather, group size diminishes with time and what we first thought of as a monogamous pair may have been a female with the last survivor of a male group.

We also discovered that polyandrous females were somewhat ahead of monogamous females in the number of young produced. Groups out-produced pairs to the advantage of group-breeding females, but not by a factor related to the number of males. Even in the most fruitful years the average polyandrous male produced only about two-thirds as many young as the average monogamous male. In poorer years, group males did even worse. How could this be the best evolutionary adaptation?

We think our data on death rates have given us the answer. Our banding studies show that polyandrous birds on territories survive at a rate of over 90 percent per year, while nonterritorial birds show a yearly rate of 50 percent or less. Joining a group reduces a male's chance of breeding each season but increases the likelihood that he will have more opportunities to father young. A male "choosing" monogamy would have to wait years to find an open territory and may die in the interim. Since the average male in a polyandrous group apparently produces more offspring in his lifetime than the average monogamous male, evolution has favored cooperative polyandry.

As I had noticed on my walks around the islands, those long-lived Galápagos hawks suffer from a space problem. On Sante Fe, territories encompass nearly the whole island. Immature birds, not having reached the breeding age of three years old, are pushed to marginal habitats and few survive. The rate of polyandry here is less than 50 percent.

The island of Santiago has more space not used for breeding, but it also has more birds desiring breeding areas. The polyandry rate is 85 percent; since the good habitats are used for breeding, birds are "eager and willing" to compromise to get in a territory and stay alive.

Although this is a twist on most mating systems, we find this explanation similar to others that deal with cooperative breeding in birds. For example, the young of the Florida scrub jay, which also has a limited range and habitat, remain on their parents' territories long after they have become capable of leaving and breeding. Despite apparent losses, a young bird gains a long stay on a safe, established territory and, ultimately, the territory itself. Researchers have found that Florida scrub jays that stay on the parental territory produce more young in their lifetimes than those that attempt to disperse and breed early in life.

In a similar way, we think the Galápagos hawk has evolved polyandry to trade short-term reproductive success for a higher rate of survival and eventual reproductive rewards. It seems clear that sharing a mate and a territory is better than not breeding at all, and that Darwinian evolution is working quite nicely on the home front.

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THE AUTHOR

John Faaborg is an associate professor in the Division of Biological Sciences, University of Missouri-Columbia.

Robert I. Bowman

In the Galápagos hawk a group of males fills in where one usually suffices.

So Keep on Looking for the Bluebird...

by **Lawrence Zeleny**

WHEN DID YOU LAST SEE a bluebird? Most people under 30 years of age would answer that they have never seen one, or they might assume that the questioner was referring to a blue jay or indigo bunting. Or they might reply that there is no such thing as a bluebird, that it is only a mythical bird dreamed up by poets and songwriters as a symbol of love and happiness. The bluebird is best known now as an adornment on valentines and greeting cards and in their sentimental verses. Yet when I was growing up in the early years of the century nearly everyone knew the bluebird and in the north looked forward to its arrival in March as the harbinger of spring.

No one can say accurately to what extent the bluebird population has declined, but observers who have known the bird well for the past 50 years will agree that the population of the eastern bluebird has probably declined by as much as 90 percent during that period. If a similar rate of decline should continue for another 50 years this bird could disappear from the face of the earth.

Michael L. Smith

The two western species, the mountain bluebird, and the western bluebird, have fared somewhat better than their eastern cousin. But they too are gradually yielding to the pressures that have been so destructive to bluebirds in the east. Bluebirds of at least one of the three species still breed in every state except Hawaii, in every Canadian province except Newfoundland, and in parts of Mexico and Central America. Bluebirds are found only in North America, except for a small population on the islands of Bermuda. The causes of the bluebird population decline are not fully understood but the major ones appear to be known.

Unusually severe winter weather often takes a heavy toll on the bluebird population, especially in the northern parts of their winter range. This is particularly true when freezing rains coat the birds' food supply of wild berries. The record-breaking winters of 1977 and 1978 almost wiped out the bluebirds in large parts of Indiana and Illinois. Catastrophes of this kind, however, have no doubt occurred many times throughout history, and bluebirds have usually recovered these losses within a few years.

The widespread use of pesticides has affected the bluebird population as it has that of so many other species. Orchards were once among the favorite haunts of bluebirds. There they helped

Bluebirds usually have two broods, sometimes three during nesting season, but they do not use the same nest more than once.

Michael L. Smith

. . . and Listening for Its Song.

Greeting card design courtesy Hallmark Cards, Inc.

Hark! Hark! I hear a Bluebird sing!
His voice rings through the purple air,
And tells me that the hand of spring
Is weaving garlands fresh and fair,
In mossy dell, or frowning fell,
And strewing blossoms everywhere.

—from "The First Bluebird of Spring"
by Gilbert S. Everhart

Lawrence Zeleny

The bluebird is more than a symbol. It is a beneficial species whose loss would be tragic.

control insects and found nesting sites in cavities in trunks and large branches of older fruit trees. Modern orchards are usually so saturated with insecticides that few birds of any kind can live in them.

Loss of habitat is an important factor in the decline of most species of wildlife and bluebirds are no exception. The decline in small farms with their orchards, woodlots, and hedgerows in favor of huge farms has made life more difficult for bluebirds and many other songbirds.

The most serious causes of the bluebirds' troubles are related to their cavity-nesting habit. Throughout the long course of evolution bluebirds "discovered" that their nesting success was greater when they built their nests and raised their young in enclosures that would protect against predators and adverse weather. Natural cavities in dead trees or branches and deserted woodpecker holes became favorite nesting sites. This habit is so ingrained that now bluebirds will almost never nest anywhere other than in an enclosure of some kind.

In recent times the supply of natural cavities suitable for bluebirds has diminished substantially. Dead trees and branches are now removed. The modern chain saw makes this task easy. High cost of heating fuel has increased the demand for firewood and thus accelerated the removal of dead wood. In addition, the old wooden fenceposts which rotted out to make bluebird nesting sites are being replaced by metal posts.

Introduction of the house sparrow and the European starling into North America from Europe in 1851 and 1890, respectively, was a major ecological blunder as far as the bluebird was concerned. Both species found North America to their liking and spread with remarkable rapidity from coast to coast and from Canada well into Mexico. Both are cavity nesters, but if cavities are not available they will nest elsewhere. Thus, shortages of natural cavities have little effect on their ability to proliferate.

Both of these foreign birds are more aggressive than the bluebird, so they compete violently with bluebirds for nesting sites. Bluebirds can sometimes defend a cavity or nesting box against marauding sparrows but not against starlings if the opening is large enough. So, where starlings are abundant bluebirds tend to disappear if no human intervention is forthcoming.

What can be done to halt the disappearance of bluebirds? Practical measures can be taken to help this troubled species.

Most eastern bluebirds spend the winter in the southern half or two-thirds of the United States. In the northern section of their winter range they frequently perish from severe cold and starvation, although they can usually withstand cold if sufficient food is available. These bluebirds depend largely on wild and ornamental berries for sustenance during the winter months. Thus, liberal plantings of berry-bearing trees, shrubs, and vines which retain their fruit throughout the winter, are a great help to bluebirds and other species.

The American holly is valuable as a source of winter bluebird food for two reasons. First, its berries do not appeal to starlings. Second, the berries are so hard during the autumn and early winter that few are eaten. But, after repeated freezing and thawing, the berries soften and become palatable by the time the supply of other berries may be nearly exhausted.

The multiflora rose, often used for impenetrable hedges, is a valuable planting. Starlings sometimes consume the berries or "hips" from the outer branches of this large shrub but refrain from entering the dense thorny interior. Bluebirds, however, will cautiously work their way through the thorns to the supply of rose hips which may help sustain them through the winter.

Other especially good berry-bearing plantings for bluebirds include mountain ash, Washington hawthorn, bittersweet, pyracantha, staghorn sumac, and autumn olive. Nurseries can offer advice concerning the varieties of plantings best suited to particular localities.

By far the most urgent need of bluebirds is for nesting sites to supplement the dwindling supply of natural cavities. Bluebirds will accept nesting boxes if they are properly designed and mounted in suitable habitat in a manner that will afford them protection. Efforts to help bluebirds by providing and monitoring nesting boxes have often resulted in the local restoration of the population to normal levels within a few years.

Bluebird nesting boxes are best made of wood at least ⅝ of an inch thick. Cedar, cypress, redwood, and exterior grade plywood are excellent since they last for years without painting. Chemical wood preservatives and "treated" lumber are not recommended.

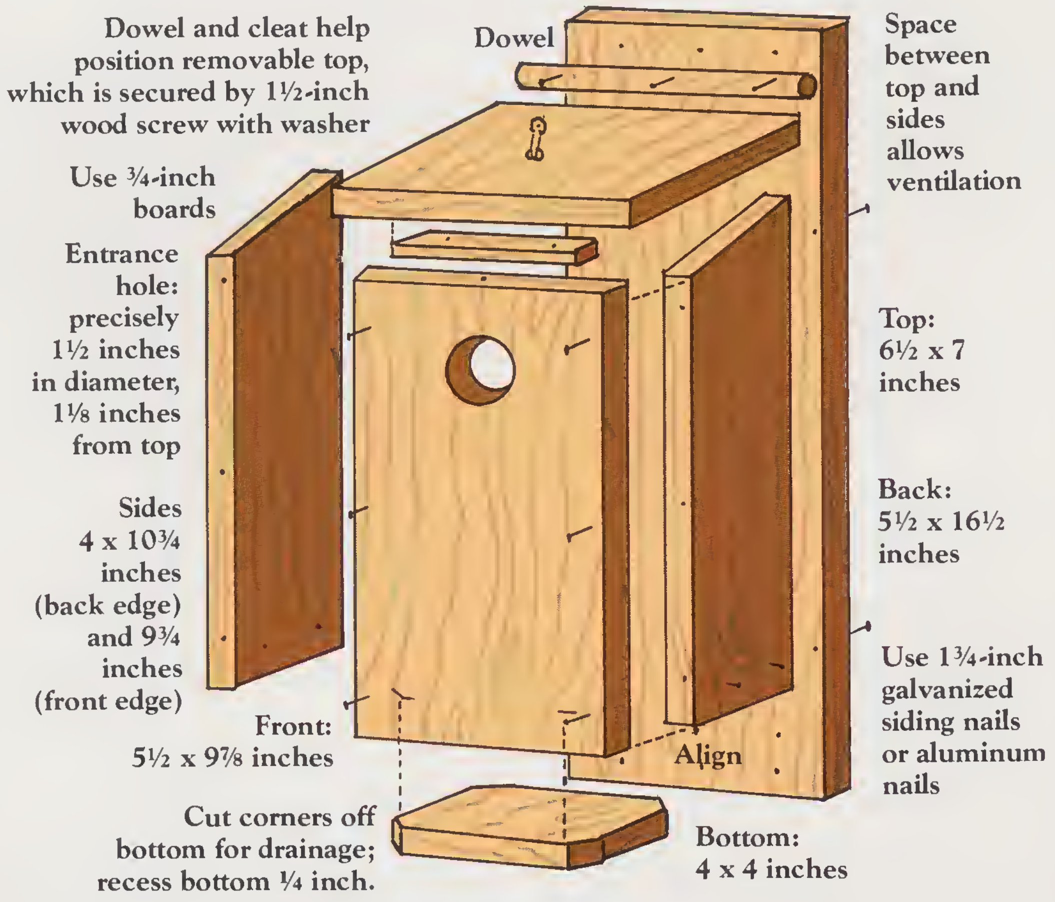
Nesting boxes should be from six to eight inches deep measured from the bottom of the entrance hole to the floor inside the box. The floor itself should be at least 16 square inches. Drainage holes near the corners of the floor and a few small openings under the roof will help keep the box dry and cool. The box should be designed so that the top, one side, or the front can be opened easily for inspection and cleaning.

The size of the entrance hole is the most critical dimension of the nesting box. The hole should be 1½ inches in diameter with a tolerance of not more than 1/16 of an inch. Smaller holes can be used by bluebirds only with difficulty. Larger holes will admit starlings

Michael L. Smith

Increased demand for firewood has accelerated the removal of trees, however, natural cavities can be supplemented with nesting boxes.

Build Your Own Bluebird Nesting Box


Dowel and cleat help position removable top, which is secured by 1½-inch wood screw with washer
Dowel
Space between top and sides allows ventilation
Use ¾-inch boards
Entrance hole: precisely 1½ inches in diameter, 1⅛ inches from top
Top: 6½ x 7 inches
Sides 4 x 10¾ inches (back edge) and 9¾ inches (front edge)
Back: 5½ x 16½ inches
Use 1¾-inch galvanized siding nails or aluminum nails
Front: 5½ x 9⅞ inches
Align
Cut corners off bottom for drainage; recess bottom ¼ inch.
Bottom: 4 x 4 inches

Courtesy National Geographic Society

Michael L. Smith

Nowadays orchards are usually so saturated with insecticides that few birds can live in them.

which will almost surely prevent bluebirds from using the box. A perch under the entrance hole is not needed and it makes the box more attractive to house sparrows.

Recent evidence indicates that mountain bluebirds in certain far western areas may need entrance holes slightly larger than 1½ inches in diameter. A 1 9/16 inch hole probably would be adequate in any such area and would still prevent starling interference.

The location of the bluebird nesting box is even more important than its design. Bluebirds rarely nest in cities or large towns except on the outermost fringes. Neither will they nest in heavily wooded areas. They like relatively open rural areas with scattered trees where the undergrowth is sparse or kept short. Pastures, large lawns, golf courses, country cemeteries, abandoned orchards, country roadsides, and open wastelands provide ideal bluebird habitat.

Bluebird nesting boxes are best mounted on smooth metal poles such as pieces of galvanized pipe. Wooden posts may also be used although without protection they are more easily climbed by predators. The trunks of isolated trees may also be used in areas where climbing predators are not a problem.

Nesting boxes may be mounted at any height over a foot. Very low mounting helps to discourage house sparrows but increases the danger from ground predators. High mounting makes it difficult to monitor the boxes. I prefer to mount my boxes from three to six feet above the ground.

It is desirable to face each box toward and within about 50 feet of a tree, shrub, or fence. That way when the young birds leave the nest they will have a place to alight on their first flight. Instinct directs them to fly to a nearby perch and to stay off the ground until they have gained strength and perfected their flying skill. Not much can be gained by mounting the nesting boxes closer together than about 100 yards because of the territorial behavior of bluebirds during the nesting season.

Nesting boxes should be monitored at least weekly during the nesting season to remove house sparrow nests and used bluebird nests as soon as the young birds have flown. Bluebirds usually have two broods during the season but they do not use the same nest more than once. Boxes also should be monitored in late winter or early spring to remove any material that may have accumulated in them during the winter.

Bluebird trails consisting of many nesting boxes placed in suitable bluebird habitat are being established in parts of the United States and Canada. The largest and probably most productive one is located in western Canada. This trail extends from the vicinity of Winnipeg, Manitoba westward beyond Saskatoon, Saskatchewan. Together with numerous side trails it covers well over 2,000 miles. Most of the nesting boxes are mounted on fenceposts 100 yards or more apart, and several thousand bluebirds and tree swallows are produced annually. Properly managed bluebird trails throughout the continent offer the greatest hope for the bluebirds' continued survival.

Thousands of people across North America are concerned about the plight of our wildlife. Many would like to help some troubled species. Bluebird conservation fills this need for those who have access to rural or semi-rural property. Hundreds of people have written to tell me of the satisfaction they felt from watching bluebirds use their nesting boxes and from the realization that they are doing something tangible to help bluebirds survive in an increasingly hostile environment.

FURTHER READING

Zeleny, Lawrence. *The Bluebird—How You Can Help Its Fight for Survival.* Indiana University Press, Bloomington. 1976.

For further information write to the North American Bluebird Society, Box 6295, Silver Spring, Maryland 20906.

THE AUTHOR

Lawrence Zeleny is the founder of the North American Bluebird Society and a past president of the Maryland Ornithological Society.

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The Case of the Common Tern

by Lucia Severinghaus

IT'S A QUIET DAWN. The surface of Oneida Lake in New York State has hardly a ripple. The only sound is my motorboat as I roar across the lake. At my approach about 30 common terns fly up from the colony, a mere fifth of what was here yesterday. Looking for an explanation, I notice that almost all the nests are empty. What has happened to the eggs I saw only 12 hours earlier? Where are the adults?

Catching sight of a boulder littered with broken eggshells and dead embryos, I realize that someone has been practicing target shooting with tern eggs. In a few hours an entire tern colony has been demolished.

This is but one common tern colony that is faced with serious problems. Many others in New York State and elsewhere have been scattered or fragmented in recent years, some traditional sites being abandoned altogether.

For the past three years I have been studying the breeding ecology of common terns on Oneida Lake. Each spring I arrive just before the birds return from their wintering grounds. Besides monitoring population trends and reproductive success of individual pairs, I am interested in learning why common terns nest on some islands while other seemingly suitable ones are not used. Within an island, nest distribution is patchy. Some areas have many nests while similar areas remain unoccupied. My hope is that my research will lead to better tern management which may improve the common tern's tenuous hold on its environment.

Common terns are long-lived, first nesting at three years of age or older, and sometimes living for more than 20 years. They winter south of the Gulf Coast to the northern part of South America. They come to the temperate regions of North America to breed, usually arriving at the site in late April and departing by mid-September.

When terns first arrive in a colony they are busy forming pairs. Feeding is an important component of courtship. They are fish eaters and, in the early phase of courtship, a male often displays his fishing skill by holding a fish across his beak and flying back and forth over the colony, uttering a "fish" call. When he is joined by a female, they fly in parallel, banking and turning in synchrony, often soaring to great heights.

Common terns are ground nesters and a normal clutch is three eggs. Often nests are only two to three feet apart; a crowded colony looks like an airfield neatly lined with little airplanes. Incubation takes about 24 days, then a tiny wet chick emerges. Young terns are black speckled and light brown in color, giving them an excellent camouflage. When motionless they look like fuzzy rocks and are not seen easily by predators.

Common terns became almost extinct in the late 19th century when their eggs were exploited for food and their feathers for the millinery trade. The Migratory Bird Treaty Act of 1918 provided protection for terns and other migratory birds, thus allowing them to recover their numbers. Common tern populations along the New England coast peaked between 1920 and 1945, then started to decline again. The trend continued not only along the coast but in inland colonies in many parts of the species's breeding range. The large common tern colony on Gull Island, Lake Ontario, for example, dwindled from more than 1,000 pairs in 1972 to zero by 1981. Many other traditional colony sites such as Onondaga Lake and Sandy Pond in New York State no longer contain nesting common terns.

Lucia Severinghaus

Some populations have fragmented onto small, near-shore islands, dredge islands, or man-made dikes. Other populations have combined to form a few large colonies offshore. In either case, terns are more susceptible to breeding failure — near-shore colonies are more accessible to human and predator disturbances, while large concentrations of birds are vulnerable because a single disturbance can affect a major part of the total population.

Common terns have been known to breed on Oneida Lake since 1928. The Oneida Lake population of 500 pairs is one of the last viable inland populations in the state. In 1974, John Bull listed 18 inland colonies in *Birds of New York State*. At present, there are only five colonies.

What is happening to the common tern? Let's take Oneida Lake as an example.

Common terns need to nest in quiet places near water. Unfortunately for terns, these areas are also popular recreation and boating spots. In 1981, the residents of the four counties around Oneida Lake registered over 35,000 boats. Even if these are used only a few times a year, the disturbance to terns nesting on the lake is more than negligible.

Real estate encroachment not only causes loss of tern habitat, but also brings children, pets, and an increase in urban wildlife (raccoons, rats) which feed on tern eggs and chicks. In addition, a colony site may lose its isolation through landfills, or may become useless to terns because of water pollution and the elimination of fish. Also dangerous to terns is the dumping of dredge material on top of active colonies.

Besides the human threat to terns, gulls present a growing concern. Many species of gulls are undergoing population expansion in North America as a result of legal protection, the availability of food at garbage dumps, and open water maintained for winter navigation. Terns, however, have more specific food requirements than gulls, hence they have not benefited from human debris.

Gulls and terns use similar colony sites; the limited amount of good nest-

Russ Charif

Lucia Severinghaus

Top: *Early in the nesting season, ring-billed gulls begin to incubate eggs at Long Island on Oneida Lake.*
Center: *Newly fledged young on rock are fed offshore.*
Right: *Research assistant Susan Moore weighs egg.*

BHL

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ing habitat coupled with increasing numbers of gulls have pushed the gulls into many traditional common tern colony sites. Even though the number of common tern nests in the past three years at Oneida Lake has remained stable, the areas they use have shifted from safer ground to peripheral, less desirable regions. Common terns, one-fourth the weight of ring-billed gulls and one-eighth that of herring gulls, are sometimes forced to use areas that flood when the lake level rises. Furthermore, gulls prey on tern eggs and chicks, making it impossible for terns to nest successfully among gulls.

Lucia Severinghaus

Above: *When motionless, tern chicks resemble fuzzy rocks.* **Below:** *A mated pair defends its territory in a squabble with neighbor.*

Because of the precarious situation of common terns on Oneida Lake, human intervention and the management of the area are swiftly becoming necessary if terns are to continue to breed there. Proper management of this population needs to cover three aspects: control of human activities, control of gull populations, and water-level management.

One way to minimize human traffic around the breeding islands is to designate them as migratory bird breeding sanctuaries.

Can we enforce planned parenthood on ring-billed gulls? For the past 30 years, gull control programs have been implemented in the British Isles, Canada, New England and Ohio. Currently, Monomoy National Wildlife Refuge in Massachusetts is in its fourth year of an active gull control program. At Oneida Lake, gull control would not eliminate the species, but rather, curb the size of the population so that nesting grounds are also available to terns.

If water-level management can prevent flooding in low lying areas, or if the islands could be built up through the deposition of dredge or other materials, and if the vegetation could be altered to provide the right combination of cover and open space, there might be enough area to continue to support the existing tern population.

Modern resource management is complex at best. It requires an understanding of the birds and their needs, and cooperation among people and management agencies. Carrying out all three management recommendations simultaneously seems essential. Even if we provide human-free habitat, terns still need to be protected from gulls. And without flood control, whole colonies can be wiped out by one sudden act of nature. None of these steps is easy, but if we are to secure our rich natural heritage for future generations, we must start now.

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THE AUTHOR

Lucia Severinghaus recently received her doctoral degree from the Cornell University Department of Natural Resources.

Russ Charif

RESEARCH & REVIEW

by Richard E. Bonney, Jr.

Off-Key Vireo

Can a bird with an abnormal song lead a normal life? Jake Rice of Arizona State University had an opportunity to study this question when he discovered a red-eyed vireo singing a strange song in Kap-Kig-Iwan Park, Ontario ("Behavioral implications of aberrant song of a red-eyed vireo," *The Wilson Bulletin*, vol. 93, pp. 383–390). From previous studies, Rice knew that the red-eyed vireo's normal song plays an important role in its interactions with other red-eyes, including pair formation and territorial defense. But he did not know whether normal song is essential in these interactions.

The abnormal song was unrecognizable to Rice as that of a red-eyed vireo, and when he played tape recordings of this song to territorial red-eyes that had never heard it before, they didn't seem to recognize it either. They exhibited far less response to the strange song than they did to recordings of normal songs. However, when Rice played the abnormal song to the misfit's four immediate neighbors, they did respond to it as if it were a normal song. Apparently, these neighbors had learned that the strange song belonged to an otherwise normal member of their own species, thus the song was functioning as a normal song.

Besides experimenting with recorded playbacks, Rice also observed encounters between normal vireos and the aberrant bird. He discovered that this bird did not have unusually long or intense disputes with other red-eyes. The bird occupied typical red-eyed vireo territory and had a mate. Unfortunately, while Rice observed the bird and its mate feeding two brown-headed cowbird chicks, he could not find the nest and so was unable to determine the bird's breeding success.

Rice concludes that for red-eyed vireos, normal song is not always an essential behavioral cue for territorial defense or for obtaining and keeping a mate. Presumably, for these important interactions with key individuals such as neighbors, natural selection favors multiple behavioral cues, which could include call notes or visual displays that function in the absence of normal song.

Short-term Hoarding

Several bird species are known to hoard food. Some jays store acorns as insurance against future food shortages. Other birds, such as certain European tits, store food for short periods of time, usually less than 24 hours. Why bother?

One theory is that these birds often are subordinate to other bird species in contests for food. Therefore, when a member of a subordinate species locates an abundant food source, it is to that bird's advantage to hide the food items for later consumption, dispersing them about its territory to reduce chances of the food being discovered by potential competitors.

Few if any studies, however, had examined this theory by assessing hoarding behavior of individual birds. Recently, Richard J. Cowie, John R. Krebs, and David F. Sherry of the University of Oxford have been working with marsh tits, *Parus palustris*, relatives of North American chickadees and titmice, to understand short-term hoarding behavior more fully. They addressed several questions: do these birds select specific food storage sites? Do they store food systematically throughout their territories? How do they recover stored foods? Cowie, Krebs, and Sherry worked with birds in the wild and in an aviary, and their results suggest that marsh tits have pretty good memories.

In their first series of tests ("Food storing by marsh tits," *Animal Behavior*, vol. 29, pp. 1252–1259), their aim was to describe hoarding behavior of individual wild marsh tits in the field. The study took place during two winters in Wytham Woods, Oxfordshire, England. In all, 13 separate experiments involving seven birds were conducted in five different areas.

To begin, the researchers allowed individually color-banded marsh tits to collect radioactively tagged sunflower seeds from a feeding tray. The seeds were numbered and placed in the tray one at a time so the researchers knew which bird had taken each seed. After all the seeds had been hoarded, the researchers used a scintillation counter to find the seeds and examine the locations in which they were stored.

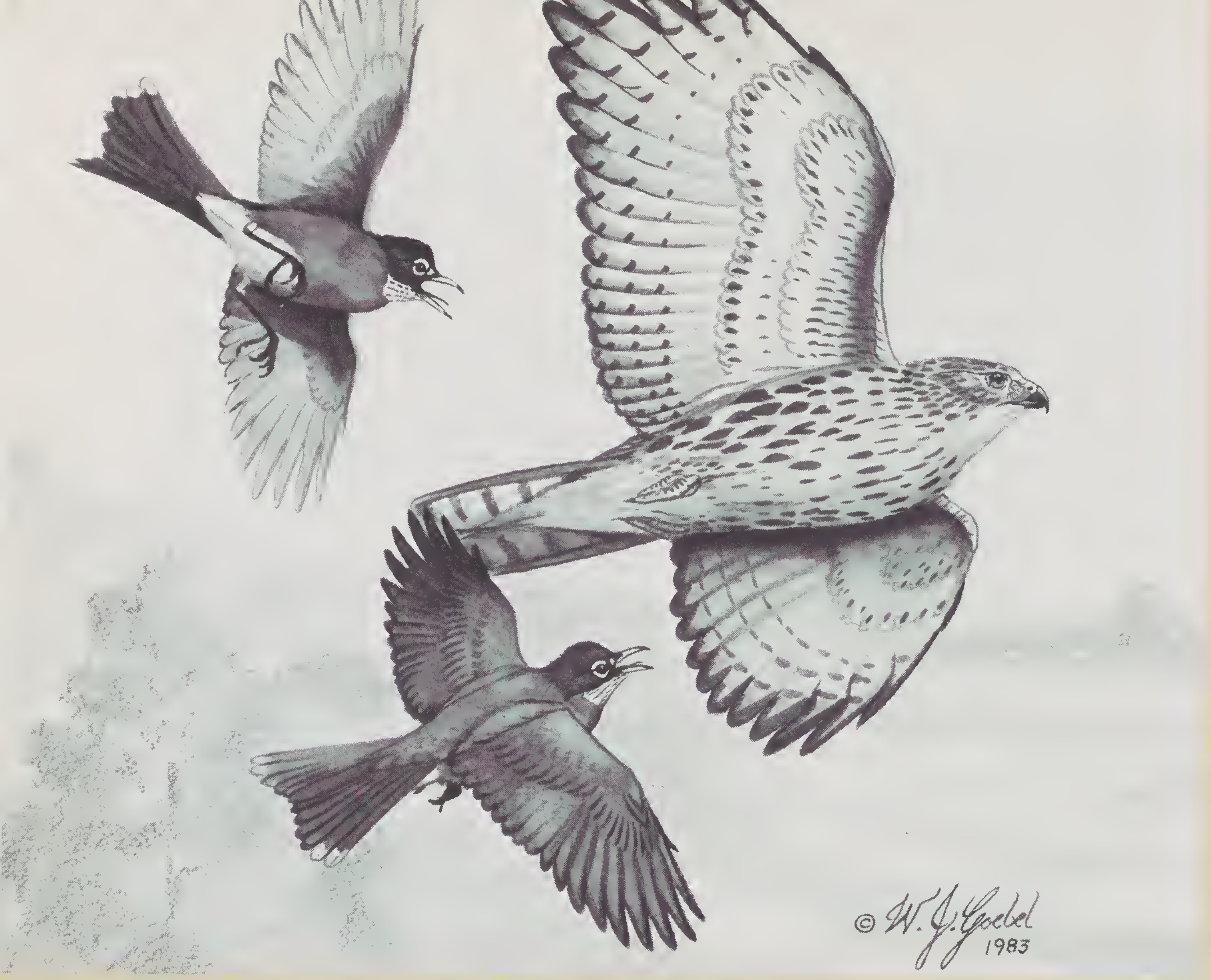
Cowie, Krebs, and Sherry discovered that the birds used five different types of storage sites: seeds were either pushed into mud or under leaves on the ground; tucked into balls of dead leaves and twigs off the ground; wedged into moss; inserted into cracks in bark; or poked into dead, hollow stems of nettles and bracken. The researchers also discovered that individual birds seemed to specialize in specific types of storage sites. Of the three birds for which there were the most data, one was a moss specialist, one favored nettle stems, and the third preferred balls of dead leaves and twigs. In addition, when both members of a pair stored seeds at the same time, they tended to use different portions of their territory.

These findings lend support to the theory that short-term hoarding functions to hide and disperse food supplies, thereby protecting them from competitors. The tendency for individuals to specialize in different kinds of storage sites most likely prevents competitors from learning to recognize one single type of site where seeds are likely to be stored. And the tendency for mated pairs to avoid storing food in the same place helps to spread out the food stores.

But if this theory is valid, then the birds must be able to recover their stored foods efficiently. Presumably, they could do this in one of two ways: either they could remember the exact places where they had hidden food, which would require a well-developed memory, or they could remember the kinds of substrates — such as bark or moss — where they had stored foods, and then search only these substrates when retrieving food. Cowie, Krebs, and Sherry devised a way to test these ideas.

Near each hoarded seed that they had located with the scintillation counter, they placed two "control" seeds. The "near control" was placed about four inches away from the hoarded seed, the "far control" about 40 inches away. Both controls were placed in sites as similar as possible to the ones used by the bird. The positions were mapped and unobtrusively marked. The researchers felt that if the birds were remembering the exact locations of their hoarded seeds, they would find them more quickly than the nearby controls. In contrast, if the birds were searching substrates, they should find the control seeds as quickly as the seeds they had hoarded.

The researchers returned to the study area at three-hour intervals to record which seeds were gone, and discovered that the hoarded seeds were found most quickly. In fact, the tits removed the hoarded seed before the adjacent near control in 93 of the 121 cases. It took the birds an average of eight hours to recover hoarded seeds, whereas near controls were discovered in



Potential predators are usually driven away.

© Wilhelm J. Goebel

about 14 hours, and far controls in about 20 hours after being hidden.

Cowie, Krebs, and Sherry feel that these results indicate that marsh tits can remember the precise locations of stored seeds, even when they store large numbers of seeds in a single day. The alternative explanation, that the birds do not remember the precise location of a hoard but return to the general area, seems improbable considering the large percentage of hoarded seeds that disappeared before the adjacent control. It also is unlikely that the birds found the hoarded seeds first because of their radioactivity; the researchers had exchanged half of the radioactive, hoarded seeds with the nonradioactive controls.

The researchers suggest that near controls are found more quickly than far control seeds because birds, having found the hoarded seed, search the surrounding area more closely and thus find the near control.

Exploration of storage behavior in the aviary sheds more light on the recovery process (Sherry, Krebs, and Cowie, "Memory for the location of stored food in marsh tits," *Animal Behavior,* vol. 29, pp. 1260–1266). Here, three captured marsh tits were tested individually in a three-phase experiment in which the birds stored and relocated sunflower seeds in moss-filled trays.

In the first "control" phase, each bird was let into the aviary for 15 minutes. As the birds explored the aviary and the trays, the researchers recorded the lengths and number of visits to each tray to determine whether the birds had initial preferences for any of them.

In the second "hoarding" phase, which immediately followed, 15 sunflower seeds were provided in a small bowl. As the birds stored these seeds in the moss, the locations of the hoarded seeds were recorded on an aviary map.

Before the third "recovery" phase, which took place a few hours later, the researchers removed all the hoarded seeds from the moss to eliminate any visual, olfactory, or other location cues from the seeds themselves. Then they allowed the birds into the aviary and recorded the lengths and visits to each moss-filled tray to determine whether the birds returned to the trays where they had hoarded seeds. Any guesses? The birds seemed to know exactly where the seeds had been stored; they returned to the appropriate trays more often and for longer periods than they had visited those trays during the control period.

It appears then that marsh tits store and retrieve food systematically. Considering that marsh tits are subordinate in food contests to blue tits and great tits, which do not store food, these findings lend credence to the theory that short-term hoarding in marsh tits serves to disperse and hide food from competitors.

Mobbing Robins

Many bird species exhibit mobbing behavior, where they encircle, dive at, and harass a potential predator. Typically, the predator is a hawk or owl, and it is usually driven away. This behavior is useful to bird watchers and ornithologists who imitate the call of a screech owl or place a stuffed owl in the field to attract songbirds. But the value of the behavior to mobbing birds is less obvious, considering the predators sometimes capture and kill their tormentors.

Researchers have noted that mobbing frequently increases during the breeding season. To Douglas H. Shedd this suggested that mobbing serves as a nest-defense mechanism. To investigate this possibility, Shedd, then at Cornell University, devised a study to test for an association between mobbing and the breeding season in the American robin, ("Seasonal variation and function of mobbing and related antipredator behaviors of the American robin," *The Auk,* vol. 99, pp. 342–346).

Shedd's study took place near Ithaca, New York over a 27-month span that included three breeding seasons. During this time, he conducted biweekly field trials in which he placed a stuffed screech owl in a conspicuous location seven feet from the ground. Using a portable tape recorder, he broadcast screech owl calls from a speaker located near the owl. From a concealed position he then observed mobbing of the stuffed owl.

Shedd discovered that mobbing occurred only during the breeding season, March through August. Mobbing frequency increased as the breeding season advanced, peaked in May or June and then declined. No mobbing was observed after August, even though robins remained in the area through November. Mobbing did not resume until the following March, after the birds returned from their wintering grounds.

Shedd feels that at least two factors accounted for the occurrence of mobbing during the breeding season. First, robins are territorial at this time and lack the option of easy relocation away from predators. Second, they may be defending their eggs or young; Shedd notes that the May-June peak in mobbing coincides with the time when 70 percent of the young are hatching and fledging.

Why does a mobbing bird risk its life for the sake of its young? Because an important goal for a parent is to perpetuate its genetic makeup, and this can happen only if the young survive.

Interestingly, Shedd observed that robins are not as eager to put their lives on the line when they are not breeding. Outside of the breeding season, robins often approached the stuffed owl silently, watched it for a moment, and then departed.

Shedd points out that his findings may or may not be valid for other species. "Given the frequent occurrence of mobbing among groups of unrelated birds," he notes, "it would be unrealistic to hope for an explanation of the function of mobbing that would apply to all species in all situations."

NEWS & NOTES

We are among the fortunate who knew Dr. Arthur A. Allen and benefited from his teaching. One day in the summer of 1963 my wife Elizabeth and I found a wood thrush nest low down and easy to observe in Sapsucker Woods. It contained three wood thrush eggs and one cowbird egg and we reported this to Dr. Allen who at that time had an office in the Laboratory. "Would you show it to me?" he said in his delightful way. Of course, we were eager to show it to him. "Why not take out the cowbird egg?" Elizabeth said. "Oh no" he said, beaming at her through his spectacles. "Let's wait and see what happens."

In two days there were four young birds in the nest and they all looked alike. Dr. Allen came again and we asked him which was the cowbird. Gently he tapped the edge of the nest with a finger and all four mouths opened, expecting food. He pointed out that three of the young had yellow mouth linings and the fourth had a red mouth lining. Seventy-two hours later there were but three young in the nest and all of them had yellow mouth linings.

We reported this to Dr. Allen and he explained that he had observed similar events from a blind when photographing. He said that the wood thrush fed only the mouths with the yellow linings and so the cowbird young died quickly and the wood thrush then took the body and threw it out of the nest. This illustrates one bird's method of defense against the cowbird and also the wonderful way that Doc Allen had of teaching.

Fred T. Ranson, member
Nalcrest, Florida

A few upcoming programs of Cornell's Adult University which may be of interest to Laboratory members are:

Spring Comes to Mohonk Mountain House. May 20–22. Professor Richard B. Fischer will guide your observations of the region's birds at the height of spring migration. Professor John M. Kingsbury will accompany you on field trips to study local vegetation, and Professor Harlan P. Banks will bring his expertise to your investigation of herbaceous and woody plants.

Introductory Ornithology. July 3–9. Laboratory staff will help you develop the skill of bird identification by sight and sound through field trips, recordings, slides, lectures, and discussions.

Avian Evolution: Explorations in the Beginnings of Birds. July 10–16. A guided tour through the world of primal birds led by John Chiment, research associate, Ithaca's Paleontological Research Institute.

For more information about these and other CAU programs, write: Cornell's Adult University, 626-L Thurston Avenue, Ithaca, New York 14850; or call (607) 256-6260.

With sadness we note the passing of Austin L. Rand (1905–1982). Dr. Rand received his doctorate from Cornell in 1932, based on his dissertation, "The Distribution and Habits of Madagascar Birds." He held posts with the American Museum of Natural History, National Museum of Canada, and Field Museum of Natural History in Chicago. After he retired in 1970, Dr. Rand had been a research associate with Archbold Biological Station, Lake Placid, Florida.

The Living Bird, the Laboratory's annual journal for 19 years, is fast becoming a collector's item. A leading publication in ornithological research, it combines technical articles and exquisite color plates. The Laboratory is now offering a limited number of complete sets (some imperfect) of *The Living Bird* to our members. Cost: $1,000. Mail your request and check or money order to Library, Laboratory of Ornithology, Sapsucker Woods, Ithaca, New York 14850.

The Shoals Marine Laboratory is offering two programs in island bird study during the 1983 season, each timed to correspond with the spring and fall migrations of birds through the Isles of Shoals. The islands' special list of birds numbers over 250, including 143 migrants or visitors and 27 species of resident breeders. Each three-day program, offered May 26–29 or September 8–11 at a cost of $245 per person, combines bird walks, field trips by land or by sea (weather permitting), and films with informal lectures and discussion.

In addition, mist net demonstrations offer participants the opportunity to observe close-up the nuances of color, shape, and size which serve to distinguish certain otherwise hard to differentiate species. The faculty is composed of expert field ornithologists familiar with both land and marine birds inhabiting the Gulf of Maine.

For more information write: Shoals Marine Laboratory, G-14 Stimson Hall, Cornell University, Ithaca, New York 14853, or call (607) 256-3717.

The Laboratory has hundreds of high-quality color slides taken by outstanding bird photographers. Slide sets, some keyed to our records of bird vocalizations, are also available. Write or call for a brochure. Laboratory of Ornithology, Dept. SP, Sapsucker Woods, Ithaca, New York 14850. (607) 256-4017.

Dear Member:

Our Library of Natural Sounds is as old as the Laboratory itself. In the library's long history it pioneered in the recording of bird song—first for the old Movietone Newsreels, later with bulky disc equipment, and finally with a succession of tape recorders. With the technical expertise of Peter Paul Kellogg and ornithological knowledge of Arthur A. Allen, the library took an early lead in technical innovations and methods for recording bird song.

These recordings have found their way into countless records and indeed, the Laboratory's reputation rests in part on its bird song records. This tradition is continuing. We've just released a revised edition of "Voices of the Night," we are preparing a set of records to accompany Roger Tory Peterson's popular field guides to North American birds, and a record set for National Geographic*'s new bird books.*

We are also modernizing the library to bring its equipment up to date. With a foundation grant, we've assembled a new studio for making master tapes for record projects. In fact, the master tape for the soundsheet accompanying this issue of the Quarterly *was produced there. In addition, we are planning a project with the Section of Neurobiology and Behavior here at Cornell to establish a regional center for the analysis and synthesis of animal sounds.*

Yet, as with almost everything we do at the Laboratory, the ultimate success of the library rests with our members and contributors. Most recordings in the library's collection were gifts, and I am continually impressed with the donors' generosity. In return, our responsibility is to guard and catalogue the recordings and to make them available for research and for the education and pleasure of all who are interested in living birds. All in all it looks like the Library of Natural Sounds has a busy and exciting future.

CHARLES WALCOTT, *Executive Director*

George Miksch Sutton: A Bird Artist's Bird Artist

by Robert M. Mengel

Portrait by Don

George Miksch Sutton 1898–1982

On one of our walls hangs a life-sized portrait of a young eastern whip-poor-will, a delightful textural study for which I yearned for many years. Beneath the signature of George Miksch Sutton are the precisely penciled words: "Signed especially for Robert M. Mengel on 8 September 1982." Although he didn't say so, I understood that this gift was Doc's farewell to me after an acquaintance that I can scarcely believe spanned 42 years.

It was the last of many generous acts for which I could never have repaid him directly. Repayment, of course, was the last thing Doc thought about. By his generosity, which verged on the spectacular, he was perhaps trying to repay the similar generosity of Louis Agassiz Fuertes. He gave away major portions of a fine working library to students deemed worthy. To one he presented a slightly used Jeep; others were subsidized by field work on behalf of a large personal bird collection now in selected museums. There is much more.

I first met him on a pre-freshman visit to Cornell in May, 1940. He took me to lunch, showed me Louis Fuertes's studio, where he lived, and a show of his own pictures. I was entranced. I had never seen anything on paper like those crisp, lively, bright-eyed birds, and I had certainly never met anyone at all like this man. I still have not.

To portray George Miksch Sutton in a few bold strokes, start with a man firmly cast in the mold of late 19th century natural history and bird painting. On this templet superimpose an intense personality of almost ascetic fervor; an equally intense, pervasive aestheticism, and a marked susceptibility to the lure of a receptive audience of any size. He may have acquired the last from his ministerial father. When he rose to speak it was easy to imagine him in a pulpit, not preaching so much as leading worship. Birds, after all, were his religion.

I particularly remember his hands. Surprisingly large and strong, they were incredibly sensitive, precise instruments whether with brush, pencil, or scalpel. It is well known that his many thousands of magnificent, beautifully labeled bird skins were the envy of colleagues everywhere. Few know that while Doc was in Michigan his friend Max Minor Peet would often visit to watch him skin, hoping thereby to improve his own work. Many did that, but Max Peet was one of the world's leading brain surgeons. He said that Doc's scalpel technique was the finest he had ever seen.

Roger Tory Peterson once said, very accurately, that Doc was a bird artist's bird artist. Equally he was a field ornithologist's field ornithologist, probably unique in being more ornithologist than any bird painter of equal note and more artist than any ornithologist of his stature. In the field he was alert as a hunting sharp-shin, a consummate hunter in search of the special kinds of beauty and knowledge that his diverse quarry provided and which, I believe, a bird painter can fully acquire in no other way.

He could thus easily rationalize a day in pheasant cover or duck blind. One memorable day in 1941 Doc treated students Dwain Warner, Bud Tordoff, and me, to his company on a day-long pheasant hunt in Ithaca. He joyously humiliated us with his skills and genially ribbed us for our relative shortcomings. Then we became aware of a large, very irate farmer bearing down upon us. We students courageously lined up behind our mentor. Doc squared his shoulders, assumed his best country squire manner, and flashed the full Sutton charm. "How do you do?" he boomed jovially, stepping forward with hand outstretched. "Sutton is my name."

"I don't give a ______ *what* your name is," came the reply, "you're trampling all over my ___________ turnips." I suspect we took some ignoble joy from this, but we were nonetheless relieved as the famous charm slowly wrought its work and we were able to emerge from our shelter.

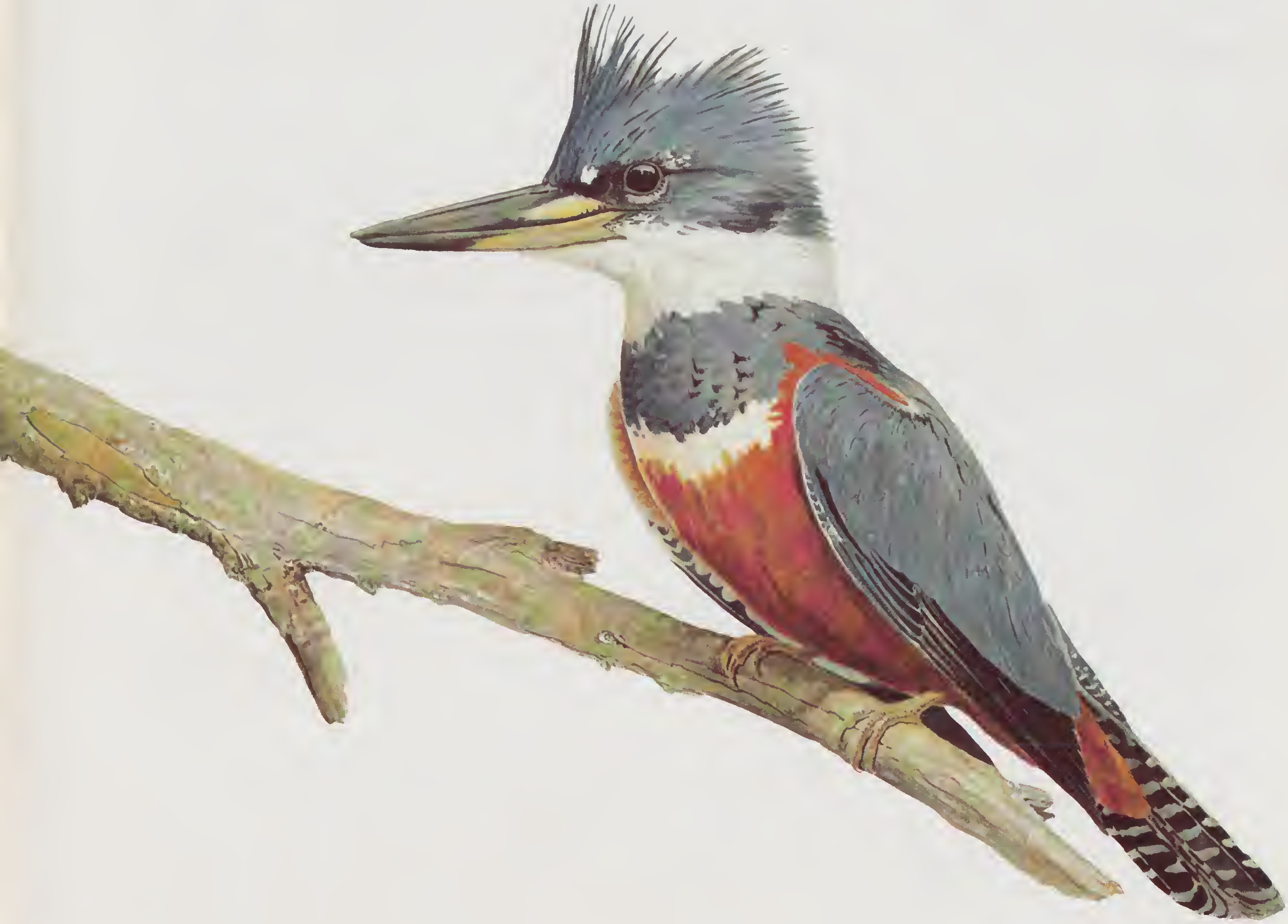
As a painter of birds, Doc was unusual in continued, life-long growth, evolving by stages from an ornithological illustrator to an ornithologically sophisticated painter whose creative need, still requiring a bird for release, was now satisfied by nothing less than total unity of design, space, and color. He was uncomfortable with art philosophy, impatient with labels and words with vague meanings. I think it pained him to try to intellectualize matters about which he felt so strongly as he did about his painting. Late in life he often said that he was not really an artist, just a sincere seeker after truth. I dislike contradicting my old teacher, but if the word is to mean anything, he *was* an artist.

In November, 1981, I spoke in the lecture series that he endowed at the University of Oklahoma in Norman. It was the last time I saw him, shockingly feeble but alert and enthusiastic as ever. While there, I lingered at a large retrospective show of his work. It was eye-opening seeing the finer old portraits done from living birds all together, the Mexican studies so patiently painted outdoors at the same time each day and, for the first time, many of the big, airy, economical arctic watercolors of his final period.

On the flyleaf of my copy of *To a Young Bird Artist*, his final bow to Louis Fuertes, is this inscription, dated 29 August 1979: "For my friend Robert M. Mengel — one person in this world who knows how great Louis Agassiz Fuertes was!" After my trip to Norman I wrote to Doc on that subject. I remarked that, while their strengths and styles were ultimately very different, I thought it now had to be said that the master had been equaled by his most distinguished pupil. In Doc's thoughtful response was no false modesty, no dissembling denial, not even a direct reference to the statement. But I think he liked it, and I believe he deserved it.

It had been a long time since March 30, 1915, when Louis Fuertes had written to him: "I don't know, yet, whether you've got the thing in you so hard that it will prove your dominant passion right through your life or not. If not, I mustn't encourage you to give your life to it; if you have, I wouldn't be able to dissuade you anyway."

The George Miksch Sutton Fund has been created by the Laboratory in the memory of Dr. Sutton. Contributions to this fund will endow seminars, art, and color plates for The Living Bird Quarterly. *Those who contribute $1,000 or more will receive a 22½" × 27½" limited edition print of a ringed kingfisher, signed and numbered by Dr. Sutton (see facing page). For more information, contact: Samuel Eliot, Laboratory of Ornithology, Sapsucker Woods, Ithaca, New York 14850; (607) 256-4288.*



GEORGE
MIKSCH
SUTTON

190 of 300 Ringed Kingfisher

George Miksch Sutton

THE LIVING BIRD QUARTERLY

Summer/1983

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THE LIVING BIRD QUARTERLY

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FRONT COVER. Northern gannets at breeding colony. Photograph by Tim Fitzharris©

BACK COVER. Outside—Black skimmers at nest. Photograph by Michael L. Smith. Inside—Brown pelican and pilings by Robert Bateman.

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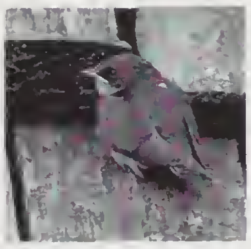

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Floaters and Fliers of the Prairie Marshes

by **John G. Sidle**

Wayne Lankinen/DRK Photo

“SETTLERS did not consider the pelican of any value and they made a practice of going there on Sundays and seeing how many they could kill by shooting them on the wing which they considered great sport.”

So wrote H. H. McCumber of the killing of white pelicans at Chase Lake, North Dakota in the 1880s. The slow, undulating flight of the pelican drew gunfire across the northern plains. Shot out of the sky and assaulted in their nesting colonies, pelican numbers dwindled. By 1900 the white pelican had been reduced to the same state as the sandhill crane, giant Canada goose, buffalo, and elk. McCumber convinced the United States Biological Survey to protect the Chase Lake pelican flock and, in 1908 with only 50 pelicans left, Theodore Roosevelt established one of the earliest wildlife refuges—then known as Chase Lake Reservation.

Elsewhere in North America the pelican suffered also. Human disturbance has forced the abandonment of over 20 nesting islands in Canada since 1900. Many nesting areas in California were abandoned because of human activities; intrusions can have a devastating effect on clutch size, hatching success, and the number of young fledged. Mink ranchers gathered boatloads of pelican eggs from Canadian lakes to feed their mink. Fishermen destroyed and harassed colonies on remote Canadian lakes as recently as 15 years ago. The belief that pelicans competed with man for fish was so entrenched that even the National Park Service killed pelicans in the 1920s and ’30s to reduce their impact on the trout population in Yellowstone Lake.

Today we wildlife managers are trying to protect and monitor the white pelican, one of North America’s largest birds. As our plane flew low over the North Dakota prairie, I opened the window and adjusted my camera. Chase Lake was coming up fast. After banking south the aircraft drifted over the white mass of pelicans on the two nesting islands. I was able to photograph pelicans, double-crested cormorants, and ring-billed and California gulls. The birds seemed unconcerned and none flew off their nests. Chase Lake is a turning point for B-52 bombers and I wondered if the birds had become accustomed to aircraft.

One of my tasks is to examine the status of pelicans on the Chase Lake National Wildlife Refuge. In the past, pelican nests have been counted by walking through the colony. Such walks flush the birds off their nests and cause pandemonium. Eggs may be broken by fleeing birds. Incubating birds may abandon their nests and expose chicks to patrolling gulls or the heat of the day.

For many species, aerial photography is as accurate as a ground nest search and has been used at several white pelican colonies. In 1980, 6,142 pelican nests dotted the two islands in the 2,004 acres of Chase Lake. Since 1980 the refuge has regained or exceeded its former pelican population, a fine example of what statutory protection can do for a wildlife population. It is now the largest white pelican colony in North America.

Across the continent in the past 15 years white pelican numbers have increased, primarily in Canada. All told, 66,000 white pelicans breed in Canada and 37,000 in the United States. Eighty-five percent of the nests are on islands in large lakes in the center of the continent. Glaciation of 10,000 years ago carved many lakes and ponds in the terrain of central North America.

Island nesting sites provide security from predators such as fox and coyote. These sites are usually far from shore and barren, although the birds will sometimes nest under trees. Most nesting islands are above water but some submerge with fluctuating water levels. Pelicans will abandon these sites and move to other islands. Although once mistreated, obdurate attitudes toward pelicans are disappearing.

The growing pelican population is encouraging but determining why a bird population changes is not easy. Populations exhibit natural fluctuations; the difficulty is judging the impact of man. Less harassment on Canadian lakes and recent sanctuary status of many Canadian colonies has been a boon to pelicans. In the United States most of the pelican colonies are protected.

Under sanctuary, pelican numbers have increased but were dampened by pesticide pollution similar to that which almost destroyed the reproductive capacity of brown pelicans. The brown pelican population, which spends the year on the Gulf Coast and the coast of California, plummeted because its environment and fish prey were contaminated with DDT, causing eggshell thinning and reproductive failure. Endrin, another pesticide, increased mortality in the population. The white pelican, which winters in the coastal estuaries along the Gulf of Mexico, California, and west Mexican coasts, was not heavily contaminated.

However, pesticide contamination in wetlands where pelicans forage resulted in the death of pelicans near the colony at Tule Lake National Wild-

Dennis W. Schmidt (Valan Photos)

Above: *Most nesting sites are far from shore.* **Right:** *White pelicans often eat tiger salamanders found in North Dakota marshes.*

BHL

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Right: *Aerial photograph of nesting white pelicans at Chase Lake in North Dakota.*
Below: *Ornithologist Craig Faanes bands a juvenile white pelican at Chase Lake.*

life Refuge, California. Cold weather and a shortage of food can cause the birds to draw on fat residues, where the contaminants are concentrated, weakening the birds further. Exposure to contaminants varies in different pelican colonies. Sublethal effects of pesticides may be wearing off the way they have in the brown pelican, perhaps due to decreased contamination in the environment.

Each April, V-formation echelons of pelicans migrate from their wintering grounds and descend on isolated prairie lakes and remote northern areas almost into the Northwest Territories. They often arrive when lakes are still frozen and remain six months before departing with their progeny.

When I first came to North Dakota, the tropical-looking pelican seemed out of place in this duck country of the Prairie Pothole Region. But these birds, with a 40-million year ancestry, are among the most conspicuous floaters and fliers of the prairie marshes. Outside my window at Arrowwood National Wildlife Refuge, 40 miles northeast of Chase Lake, large flocks often fish before breeding. Some of the birds are stopping over before continuing north, as do the geese.

John Sidle

John Sidle

Chase Lake Pass is no longer the place of Sunday afternoon pelican shoots but rather the launching point for the canoe of the wildlife manager. During periodic visits we gather eggs for pesticide analysis, conduct behavioral observations, or band birds for migration studies. With fellow refuge manager Phillip Arnold, I set out to the nesting islands to collect eggs. A strong wind on the bow lapped water against the canoe and spray dried white on my hands. Nestled among hills and without an outlet, the lake is strongly alkaline and salts pile high along the shore. Bird life surrounded us, shorebirds on the flats and waterfowl along the rushes.

In the distance I could see a mass of white on both islands. Our course took us to the easternmost island and soon individual white pelicans took shape. Drawing closer a hubbub of ring-billed and California gulls flew out and scolded our approach. These brazen guardians are common breeding associates of white pelicans and their raucous scorn may deter predators swimming toward the islands. Common terns rose up from the island's saddle to register their complaints. The pelicans remained on their nests but once on shore I could hear their low grunts of dissatisfaction.

It was early in the breeding season and most birds were incubating. Last year's marsh elder growth was incorporated into many pelican nests. Two large white elliptical eggs rested underneath their webbed red-orange feet. To avoid panicking the birds I slowly approached the edge of the nesting group. They stepped off their nests and I quickly collected one egg from each of 20 nests. Subsequent analysis showed normal eggshell thickness.

Some of the orange chicks that had already pipped appeared helpless in their new world. Within one week they would be lightly covered with dirty white down. Elsewhere a courting party carried on courtship displays. Their courtship garb consisted of a white nuptial crest and a horn on their bills. During incubation their crest would turn grayish black and the horn would fall off.

Male and female, which have identical plumage, take turns incubating. Near midday the relieving bird will return from fishing and spiral down with a whooshing sound. The changing of the guard is unceremonious and the colony resumes its sedate character.

Pelicans are synchronized in their breeding, but different groups arrive to breed over several weeks. At one location on the island, adults may be incubating and at another spot they may be performing their courtship rituals of strutting and bowing. At three weeks of age the young will group together into pods and roam the island. Parents will continue to feed them but spend less time with the young as they grow larger.

Throughout the breeding season many young perish. The first laid egg hatches several days ahead of the second egg, causing considerable size difference between nestmates. The bigger chick pecks on the little one and the intense rivalry may be fatal. In some years at Chase Lake most chicks from the second eggs died within two weeks of hatching, but this system has evolved to ensure the survival of at least one chick.

In early August I was again airborne over Chase Lake, this time to photograph juveniles. It was near fledging time and this count would tell me the number of pelicans about to leave the nest. The young were large, their wing feathers brown, and pouches and feet a light grayish yellow. Some were just offshore in the shallows but most of the 4,211 birds were wandering on the barren nesting area. On the ground it would have been difficult to count the thousands as they rambled into the tall marsh elder.

Before these pelicans began their southward migration, I hoped to band and mark 200 of them. What we know about pelican migration we have learned from the metal leg bands. Each band carries a serial number and legend, NOTIFY FISH AND WILDLIFE SERVICE, WASHINGTON, D.C. When a band is recovered, the details of a pelican's journey unfold.

I landed on the westernmost island with a crew of six. Although visits to the islands early in the breeding season can be stressful to the young, later ones do not cause panic. Our goal was not only to band but to place numbered red vinyl markers on a wing of each bird. This would enable us to recognize individuals.

On the island's saddle I spotted a flock of about 100 young pelicans. They lacked the silent dignity of the adults. I positioned the crew to guide the ungainly birds into the net. Once shepherded in we quickly closed it around them. With pliers in hand we jeweled their legs with aluminum bands and marked their wings. Liberated, many tried to re-enter the net but soon they huddled together and waddled away on the pebbly mud.

The remainder of the pod moved back and forth in the net with pouches fluttering and wings haplessly extended. I glanced above to a thermaling flock of adults, white against the blue sky. In a short time these flightless subjects would master flying and glide south on rising air currents to their wintering grounds. In a few years they would breed at Chase Lake or link up with another colony on the northern plains.

Although the breeding grounds of white pelicans are better protected and numbers of pelicans are up, problems still exist. In Canada, power and irrigation projects threaten several colonies. Subsurface withdrawals of water for yearly irrigation may affect the water level of Chase Lake. Should the level drop on this shallow lake, the islands could be bridged to the lakeshore and predators could easily gain access. Wetlands, major sources of food for pelicans, continue to be destroyed for conversion to cropland. Though white pelicans do not require vast expanses for nesting, their habit of nesting in large numbers on small islands leaves them vulnerable.

This unusual, majestic, almost prehistoric bird has survived the great transformation of the northern Great Plains wrought by the settler's gun and plow over 100 years ago. Still, we must continue to be cautious in assessing the status of these birds and be watchful of developments which may threaten breeding and wintering areas.

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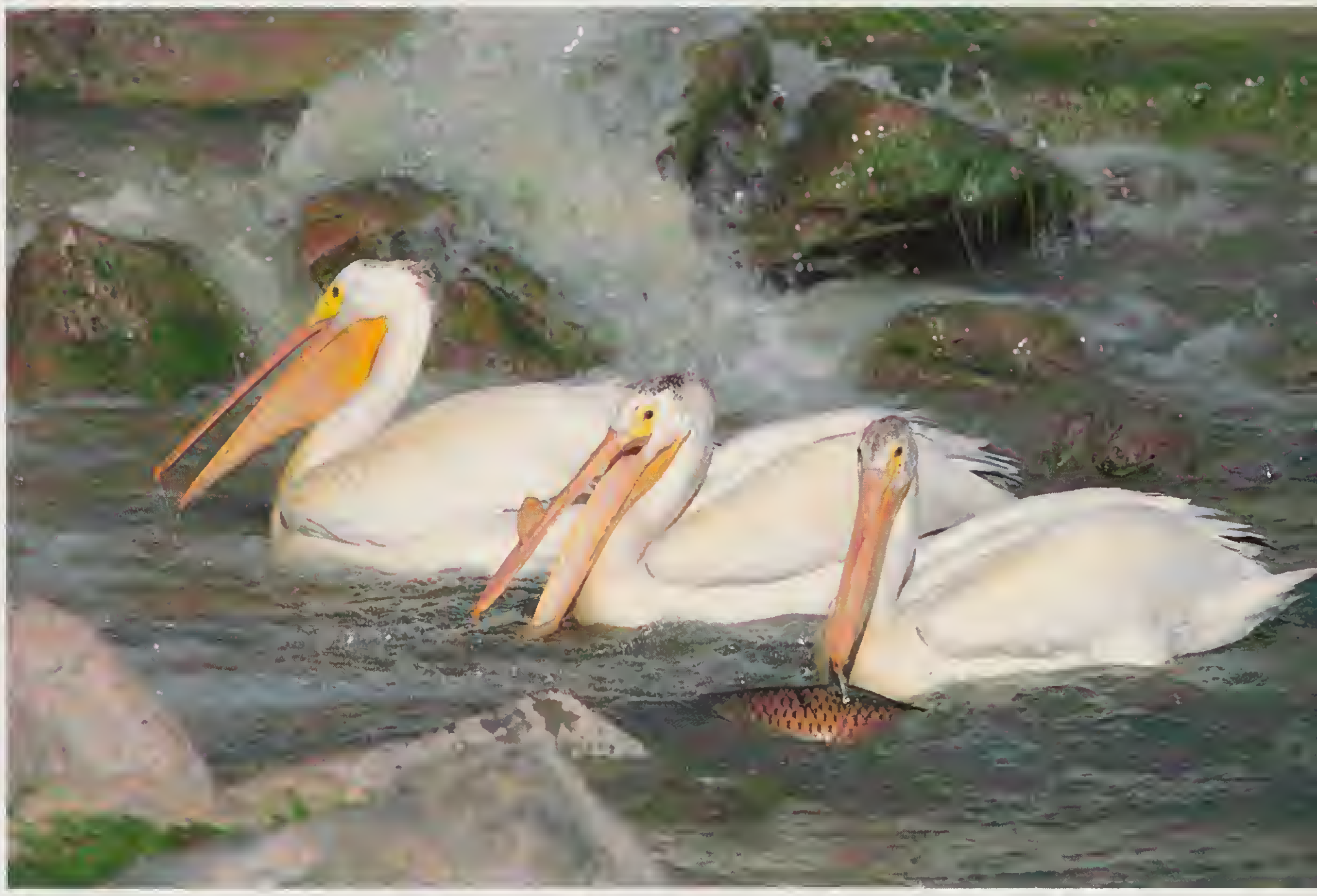
H. Cruickshank/VIREO



Bob & Clara Calhoun© (Bruce Coleman Inc.)

Top Right: *Young feeds from pouch of adult.* **Right:** *Courtship garb consists of a white nuptial crest and a horn on the bill.*

What's That Bird Doing?

Michael L. Smith

Left: *Marsh wren collects nesting material.* **Above:** *During the nesting season conflicts often occur between neighboring birds. Here a common tern descends on a black skimmer.*

Tim Fitzharris©

by Gordon M. Meade

HE LOOKS AT HIS WATCH. It reads 3:45 a.m. It's mid-May and spring is in full flush. As he stands in the fragrant woods he hears the dawn chorus beginning to swell. For the atlaser the woods contain the challenge of spotting POs, PRs and COs for a PIWO or a SWOW. By August he will have found several of these and will be able to mark Block 5492A as "adequately covered."

What draws a person into the predawn twilight? What is the meaning of this alphabetic jargon? Why are a burgeoning number of birders becoming involved in atlasing?

An atlas is a survey of where in a given geographic area a bird species breeds; usually the breeding locations are plotted on a map, hence the term atlas. Producing an atlas of the distribution of life forms dates back more than a century. Only recently, however, has it come into wide use as the need to monitor and understand our environment increases.

In the 1860s a German botanist, Herman Hoffmann, plotted the occurrence of certain plants in central Europe. The British, concerned with the possibility of extinctions, resurrected and refined the method in the 1960s by superimposing a grid on a map to determine the distribution of plants of Britain. Wherever a species of plant was discovered it was plotted in the proper square. The result was a picture of the geographic range of plant species. Following the British lead, American botanists published *An Atlas of the Vascular Flora of the Carolinas* in 1965. In 1976 British ornithologists published *An Atlas of the Breeding Birds in Britain and Ireland.*

The British atlas became the prototype for a much larger endeavor, the atlasing of all Europe. At present, atlases have been made for Denmark, France, the Netherlands, Switzerland, and West Germany, and are under way in other European countries, Australia, New Zealand, and Africa.

The first avian atlas in this country was done in Montgomery County, Maryland in 1971 as a pilot to determine its feasibility and to learn techniques. Since then statewide surveys have been completed in Massachusetts and Vermont. In both states several species were found as breeders for the first time, and species known to breed in the state were found in localities not previously reported. Surveys are now under way or being planned or discussed in at least 22 states. In Canada, atlases are in progress in Ontario, British Columbia, and the Maritime Provinces. In Ontario new breeding locations for the bald eagle and Henslow's sparrow have been found; Kentucky warblers have been heard singing on territory for the first time, and the California gull was recorded as a new breeder.

The immediate result of atlasing is a map showing where each species of bird is breeding or suspected of doing so. But what are the long-term benefits of plotting a detailed map? By showing where species breed it gives a base against which to measure ecological changes in 10, 20, 50 years from now. It signals species and habitats that require study and protection. Land planners and park commissions are assisted in their educational and preservation efforts, while developers and corporations use the data to prepare environmental impact statements. Bird atlases have already served as models for surveys of other life forms such as marine algae, lichens, spiders, and fleas.

Methods of conducting atlas surveys in the United States are based on those established in Britain. The first ingredient is an organization which will start the activity. In Vermont it was the Vermont Institute of Natural Science, in Massachusetts, the Massachusetts Audubon Society, and in New York, the Federation of New York State Bird Clubs and New York State Department of Environmental Conservation jointly, with support from the Cornell Laboratory of Ornithology and the National Audubon Society.

Once the administrative structure is in place, the survey area is divided into equal units. Usually 36 square miles are divided into manageable blocks of about nine square miles. The squares are numbered and the blocks lettered, hence the meaning of the number-letter combination 5492A, (which is my square in the Adirondack woods, 20 miles west of Lake Placid, New York).

Before surveying, criteria are set for judging whether a bird is breeding in a block or is only a transient. Breeding evidence falls into three categories: Possible (PO), Probable (PR), and Confirmed (CO).

One key a surveyor uses to decide if a bird is breeding is its behavior. Finding a nest is not essential. In fact, surveyors are urged not to seek nests because the disturbance may cause birds to abandon their nests.

If a bird is seen in the proper nesting habitat and there is no other indication of breeding, or if a singing male is present, or if breeding calls are heard in breeding season, the record is marked as Possible (PO).

For breeding to be considered Probable (PR) the atlaser may witness a range of behavior, from a pair being observed in suitable habitat in breeding season to birds building a nest or excavating a nest hole.

The killdeer that tried with a wing-dragging performance to lure me away from its nest gave confirmation of breeding—CO-DD (Confirmed by Distraction Display). Even stronger evidence came from the chestnut-sided warbler pair that kept dashing into a patch of red osier dogwood carrying worms and insects in their bills. I recorded them as CO-FY (Confirmed by Feeding Young).

Once the squares and blocks have been plotted, breeding criteria established, and maps and instruction booklets distributed, the surveyors are ready to go afield.

Leonard Lee Rue III

Leonard Lee Rue III

Sullivan & Rogers (Bruce Coleman Inc.)

Top: *Pair of ospreys about to copulate.* **Left:** *Displaying sage grouse indicates probable breeding.* **Right:** *Courting ceremony of cape gannets is a* **PR** *to an atlas worker.* **Far Right:** *Common merganser brood is a* **CO.**

An atlaser's work begins as early as February when he scouts for hawk and owl nest sites and watches for birds to take possession and start keeping house. As spring migration begins, he spends more time searching haunts for hints of breeding. In May, June and July he reaches his block at dawn because the most fruitful hours in the field are the three after dawn and the three before nightfall. Nesting areas of nocturnal species such as owls, woodcock and whip-poor-will are located by listening for after-dark calls. Atlasing draws to a close in August.

On entering a block the worker watches for the most compelling evidence of breeding behavior. For example, on the first visit he may hear a house wren singing and records a PO-X for possible breeding. When he goes back a few days later and sees a pair with the male trembling his wings and "flutter flighting," the breeding likelihood is upgraded to PR-D (Probable, courtship Display). Three weeks later the surveyor triumphantly checks off CO-FY (Confirmed-Feeding Young) when he sees the birds repeatedly entering the nest box with worms to feed the young.

On a visit to a block a surveyor may have confirmed (CO) four species and observed six probables (PR). And what are PIWO and SWOW? They stand for *PI*leated *WO*odpecker and *S*aw-*W*het *OW*l as written in a four-letter shorthand devised for recording birds' names. It has been adopted by a number of atlas projects and incorporated by many surveyors into their atlas language.

Because of the vast areas, limited time and manpower, and mass of observations to be recorded, an atlas project usually takes at least five years to complete. Every effort is made to cover every block but when this is not feasible, mapping units are selected randomly or according to a predetermined pattern which gives a representative sampling of habitats and bird life. Remote or inaccessible units such as those in wilderness may have to be surveyed by "block-busting." This is an intensive, one- or two-day survey by an expert team.

Under any system—complete, random or selective—the question arises as to what is "adequate coverage" of a unit. Even with daily visits by a knowledgeable birder it is impossible to find, let alone confirm, all species in all blocks even in five years. The British discovered that experienced workers in accessible blocks could find 50 percent of the breeding species in two hours, 75 percent in 10 hours, and 87 percent in 16 hours, but 100 percent were not found even after 200 hours. Satisfactory atlases were obtained if 75 to 80 percent of the species were found.

In Vermont adequate coverage was finding 75 percent of the species believed to occur in a block with 50 percent confirmed. In New York the standard is 76 species with 38 confirmed. Any figure is only an approximation because many blocks have nowhere near 76 species (the center of a city) and some blocks will contain over 100. The number found will be influenced by the skill and diligence of the surveyor. The New York project encourages surveyors to draw a graph for their blocks with the number of hours of observation on the horizontal axis and the number of species found on the vertical. When the curve levels off it is time to move to another block.

As they work a block, surveyors record their findings on field cards. At the end of the season the findings are summarized and eventually reach a central data bank. New York's data are computerized by the Department of Environmental Conservation. The mass of data (38,000 items were stored the first year, 63,000 items in the second year) is meaningless without analysis. Computer analysis can disclose many important facts including the number of blocks surveyed in each region, species found in each category in each block, region, and the state. In its first three years, three new breeding species were found in New York State—Forster's tern, boat-tailed grackle and blue grosbeak. In its five-year survey Massachusetts found 12 new breeding species. Vermont found eight.

Computer graphics have been developed that make data visually meaningful. On a map of the state a computer prints the location of PO, PR, and CO symbols in the appropriate blocks. The result is a map for each species showing in which blocks it has been recorded. Thus one can follow progress from year to year, see what areas have been covered, and what remains to be done.

In addition to the ecological value of atlasing, birders have found it to be fun. No longer do they simply look for field marks to answer "What bird is that?" The making of lists is no longer the major goal. Now the birder observes what a bird is doing and tries to interpret what its behavior means. Is it signifying breeding by performing a distraction display, singing on territory, building a nest? Is it expressing aggression, submission, alarm, warning, distress or fear?

The end of spring migration no longer signals the summer doldrums of birding but rather the beginning of new discoveries and the possibility of contributing meaningfully to scientific knowledge.

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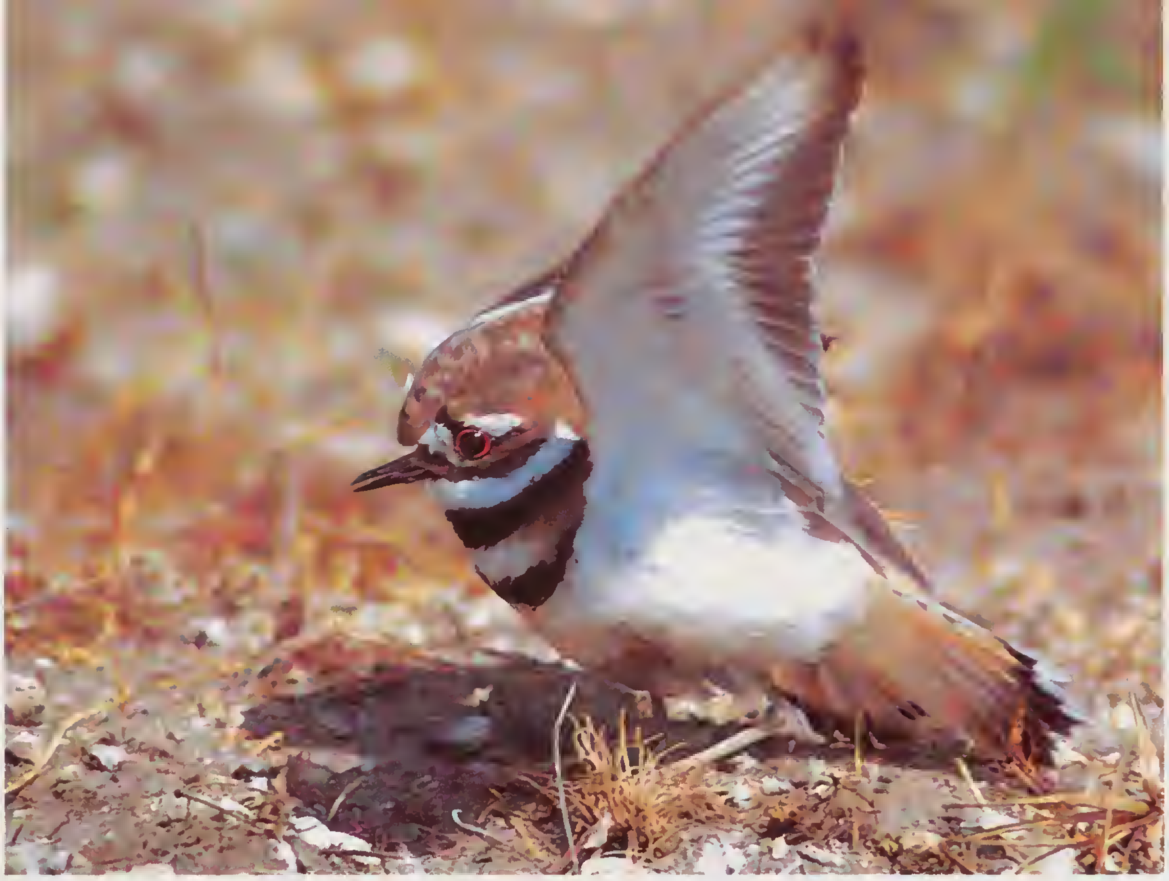
Wayne Lankinen/DRK Photo

Covering Block 4373A

by Dorothy W. Crumb


M. P. Kahl

The distraction display of the killdeer is enough information to confirm breeding.

A FEW YEARS BACK most of us in New York State were new at locating breeding birds for the atlas. We had our instructions, maps, and forms to fill out. We had a wide choice of areas to cover. I did some work on the block where I live—no real planning, just walking around listening for singing birds. It was fun, but I decided to go further.

Wilderness areas were out. They were too far away, but also I have no sense of direction. If I am in the woods and walk around a tree to look at a bird, I forget where I started. I thought it would be best to leave the remote areas to people who are good at finding their way.

Twenty-five miles southeast of my home near Syracuse is Georgetown, New York. This block looked good, so armed with map, field checklist, food, thermos, and insect repellent, I started for Block 4373A just before dawn on June 21st. The day was perfect—cool and windless. I watched for points on the map to be sure I had crossed into my block before starting my count. I passed Jones Road and watched Tioughnioga Creek on my right. When it crossed under the road I began.

Right at that point I heard alarm notes of a killdeer. I walked toward it. It immediately went into a distraction display which was enough to confirm the species without further disturbance. I walked away and listened for other songs to add to my list—song sparrow, red-winged blackbird, field sparrow, yellowthroat—all were present. I made a few "spishing" noises. A song sparrow instantly appeared with a worm. A red-wing carrying food sat up on a small tree. Two more easily confirmed, using the symbol FY for feeding young.

I had made arrows on my map so I could follow the route, but they hadn't prepared me for Chapin Road which appeared as a thin black line and perfectly flat. In reality, it went straight up. I made a stop just before I climbed the hill. A small creek passed under a bridge and opened into a wet meadow on the west side. Here I logged a spotted sandpiper, green heron, barn and rough-winged swallow. I had the pleasure of seeing four newly fledged rough-winged swallows lined up on a fence near this bridge impatiently awaiting handouts from busy parents.

I reached an abandoned barn at the crest of the hill. Phoebes and cliff swallows had taken up residence. The surrounding area is mostly hayfields and alive with savannah sparrows, bobolinks, red-wings, a pair of eastern kingbirds, crows, and a pair of kestrels. A pair of hunting northern harriers caught my eye. They spent the summer, but I'm afraid the mowing of the field may have disturbed the nest. Hindsight tells me I should have alerted the farmer that this hawk rarely nests in our area. Later he told me he would have tried to avoid mowing the nest area. The hawks never returned.

I started down the other side of the hill into state reforestation land that had been planted 50 years ago. Except for the hilltop and Georgetown itself, the block was old hardwoods or planted evergreens. Old fire roads and well-worn trails made access easy to the wooded areas. The din was unbelievable. I got so sick of hearing magnolia warblers that I kept wishing they would keep quiet so I could hear other songs.

During a coffee break I tuned in to wood warbler music. I sorted out black-throated green, Blackburnian, magnolia, ovenbird—but what was that strange one? It sounded like a Cape May, but I knew it was highly unlikely since they're rare here. I detoured to track down the bird in the tall spruces. It didn't sing constantly, but it seemed stationary. Much to my surprise it was a Cape May, probably a late migrant.

Being alone I got brave and tried my ridiculous imitation of a barred owl. In addition to being mobbed by golden-crowned kinglets, chickadees, nuthatches, juncos, warblers and a solitary vireo, an adult Cooper's hawk came screaming in. It took one look and sailed off. Things quieted down after this appearance of the enemy, but I felt something else lurking. As I turned to leave I realized the lump in the tree up ahead was a barred owl.

I worked the town area to find chimney swifts, house sparrows and starlings. I did brushy creek areas for flycatchers, goldfinches, blue-winged warblers. In only one spot did I find a cardinal and redstart. I hiked back to a pond where I saw a goshawk fly over and was warned off by an angry Canada gander. Wood duck, pheasant, horned owl and horned lark must have been in the block somewhere, but I didn't locate them.

I topped a hill to come down into the woods and crossing the road were two huge wild turkeys and an uncountable number of balls of fluff on long legs. It was the first time I had seen wild turkey poults.

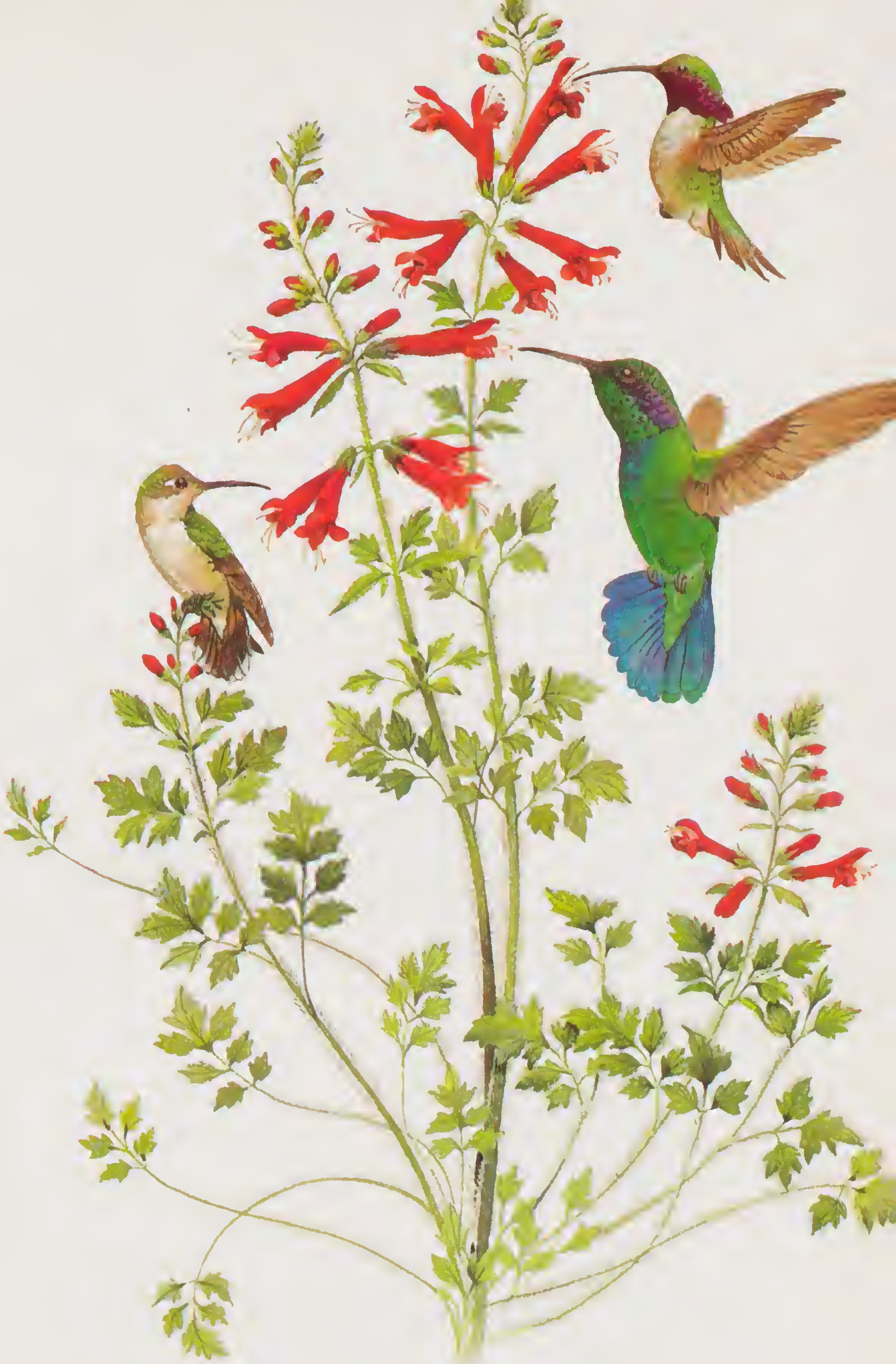
I found seven species of hawks in the block, five of which I confirmed. Broad-winged and red-tailed hawks were carrying food for young. Sharp-shinned, Cooper's hawk, and kestrel had fledged young. I never found nesting evidence for the goshawk, although I saw flying individuals in three areas.

The block is an excellent birding area that so far has produced 103 species. While most blocks are exciting, one with no diversity of habitat can be rather dull, but even a block that is largely farmland can be saved when you stumble on a singing short-billed marsh wren. Or if you see tiny upland sandpipers running after a gigantic parent. Or if you see a lineup of fuzzy kingbirds so intent on watching for food they ignore you. Nothing in the world of atlasing can be boring. Go out and see for yourself.

Dorothy Crumb is Region 5 coordinator of the New York State Breeding Bird Atlas.

The Hummingbirds of North America

Paul A. Johnsgard



> "Of all the numerous groups into which the birds are divided there is none other so numerous in species, so varied in form, so brilliant in plumage, and so different from all others in their mode of life."
>
> –*Robert Ridgway*
> The Humming Birds, *1889*

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Paul A. Johnsgard, well known for his ornithological publications, is a professor of life sciences at the University of Nebraska-Lincoln.

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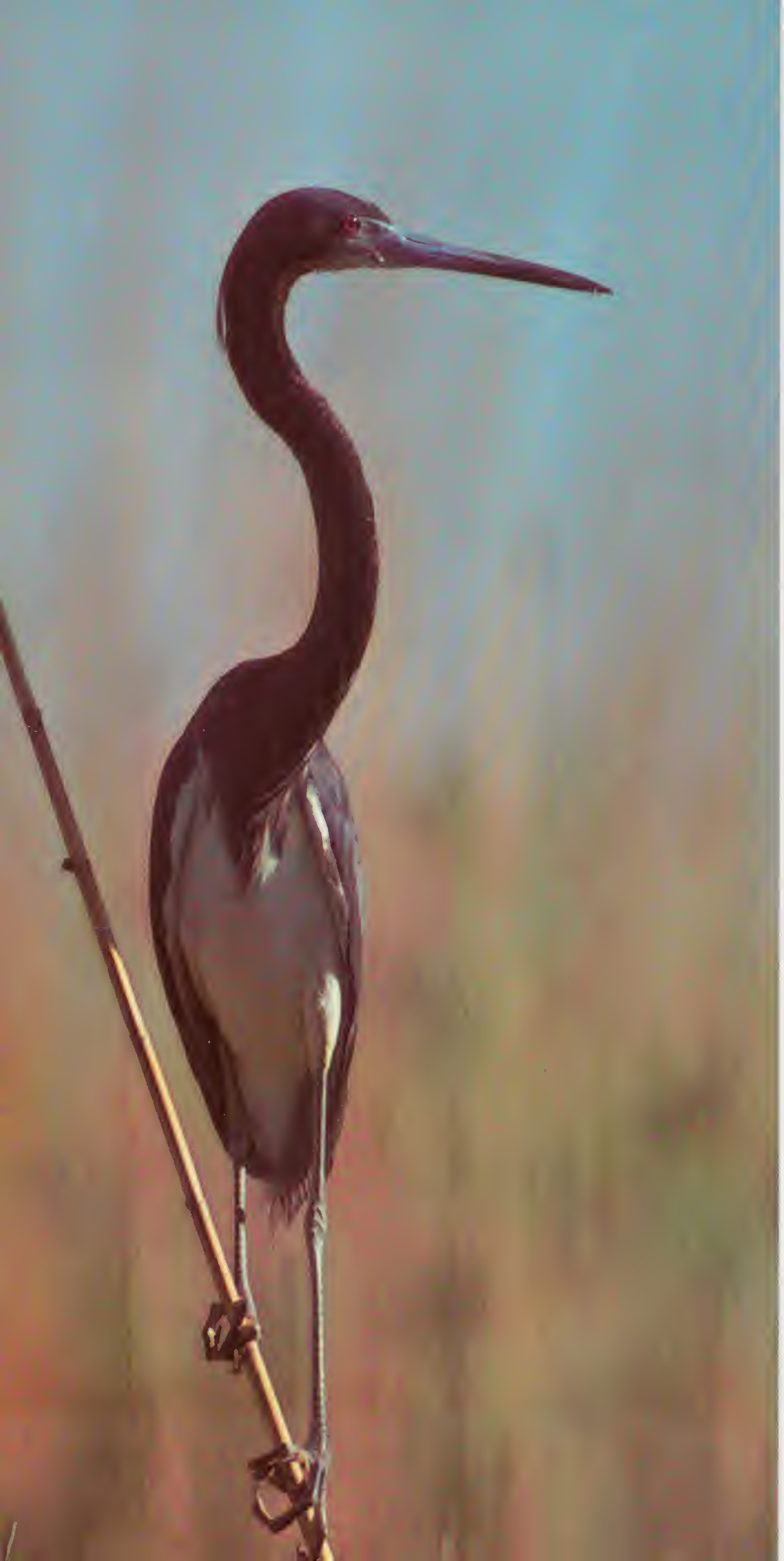


M. P. Kahl

The More Things Change...

by Kenneth C. Parkes

Once upon a time, a committee of senior members of the American Ornithologists' Union (A.O.U.) compiled and published a new edition of the Union's "Check-list of North American Birds," the first revision of this work for two-and-a-half decades. The committee had made many changes in classification and scientific names. Some had been previewed in Supplements in the Union's journal, *The Auk.* But to many, the new Check-list came as a shock, as they were not prepared for the changes in English names.

Adverse criticism was not long in coming. The committee was accused of knuckling under to the British. "What was the matter with a descriptive name like 'Red-backed Sandpiper'—why do we have to use a silly name like 'Dunlin' just because the British do?"

There must be something unpatriotic about a committee that could countenance changing "American Egret" and "American Merganser" to "Common Egret" and "Common Merganser." Even regional patriotism was outraged; "Maryland" was replaced by the banal "Common" for the Yellowthroat. A fine old traditional name, "Man-o'war-bird" was scuttled for "Magnificent Frigatebird," for a species no more magnificent than the rest of its genus.

A major policy change, the use of English names only for species and not for each subspecies, deprived birders of the quaint names they had faithfully entered into their field notebooks as they traveled around the country—

California Murre, MacFarlane's Screech Owl, Long-tailed Chickadee—had all disappeared.

Some readers may realize that I have been writing about the transition between the Fourth (1931) and Fifth (1957) Editions of the A.O.U. Check-list. But the nature of the complaints, if not the actual examples, will be painfully familiar to the ornithologists with whom I served on the A.O.U. Committee on Classification and Nomenclature (often called the "A.O.U. Check-list Committee") that compiled the Sixth Edition.

At this writing, the Sixth Edition is in press, and should appear shortly. Nevertheless, Committee members have already received a flood of comments, mostly negative, based on a Supplement in the July 1982 issue of *The Auk,* a bare-bones list of those species that had been in the Fifth Edition, under the names to be used in the Sixth Edition.

The first five editions of the Check-list had as their geographic limits a "North America" consisting of the continental United States and Canada, Baja California and Greenland. The Sixth Edition expands its scope to include all of Mexico and Central America, the West Indies, and the Hawaiian Islands, but omits Greenland as being more akin to northern Europe in its avifaunal relationships.

In addition to the expansion in geographic coverage, the Sixth Edition departs from its predecessors in several ways. Most noticeable is the omission of subspecies accounts, the Sixth Edition being entirely a species-level list. This departure was made for highly practical reasons. The geographic expansion of the list has more than doubled the number of included species. The Committee knew that in order to present a check-list with reasonably definitive subspecific classifications, far more research was necessary than could be done before the publication deadline.

Previous editions of the check-list, although also based on voting and compromises by members of committees, had presented their classification and nomenclature as though these were "Holy Writ." In the Sixth Edition, by contrast, detailed footnotes mention alternative opinions as well as widely used English names other than those chosen by the present Committee.

Although the members of the A.O.U. Committee were chosen for their taxonomic expertise, most if not all of them are recreational birders, knowledgeable about and sympathetic with the interests of amateurs. The late Eugene Eisenmann, long the Committee's Chairman, was a lawyer, not a professional ornithologist, and was widely known for his encouragement of other amateurs. The Committee that completed the Sixth Edition (after several personnel changes) included Burt L. Monroe, Jr., Chairman (University of Louisville); Kenneth C. Parkes, Vice-Chairman (Carnegie Museum of Natural History); Lester L. Short, Secretary (American Museum of Natural History); Richard C. Banks (U.S. Fish and Wildlife Service); Thomas R. Howell (University of California, Los Angeles); Ned K. Johnson (University of California, Berkeley); and Robert W. Storer (University of Michigan).

The members understood that changes in English names have an impact on far more people than do changes in scientific names or of order and family sequences. Many hours of Committee time were spent in discussing alternatives among English names, often using solicited outside advice.

The very short introduction to the July 1982 Supplement stated only that "English names, where changed, were adopted with a global viewpoint." A preface in the Sixth Edition, unprecedented in its comprehensiveness, presents thorough discussions of the principles adopted by the Committee in coming to its decisions. I would like to expand here on some of these principles.

The key factor in choosing English names was the principle of "a global viewpoint." In the past 25 years there has been a tremendous increase in international birding. Birders from all over the world may carry their favorite recreation to every continent, even Antarctica. By no means were all of these world-hopping birders Americans. Tourists from Great Britain, Australia, New Zealand, and other English-speaking countries are as avid as Americans in their desire to see new birds. Germans, Scandinavians, Japanese, and others have also become global birders, but most of the new field guides are written in English, so the only alternative to using scientific names is learning the English names.

And here, indeed, was the rub. A major problem confronting the Committee in trying to find globally acceptable English names was the multiplicity of names available for the same species. *Phalacrocorax carbo* is called Great Cormorant in North America, Black Cormorant in Australia, White-necked or White-breasted Cormorant in Africa,

S.J. Krasemann/DRK Photo

Left: *Tricolored heron, a.k.a. Louisiana heron.* **Right:** Pluvialis dominica, *lesser golden-plover was American golden plover.*

M. P. Kahl

and just "the" Cormorant in Britain.

The opposite problem was the duplication of names—the same English name used in different parts of the world for unrelated species. "Mourning Dove" to a North American means *Zenaida macroura;* that same birder traveling in Africa would find that it meant *Streptopelia decipiens.*

In spite of the efforts of several authors who have recently published competing lists of birds of the world, we are far from a consensus on English names for all species. Nevertheless, the Committee agreed with the principle of striving for global standardization, so that the next generation of birders would know what species was meant by "Mourning Dove" in conversations with any English-speaking colleague.

Some of the conflicts caused by duplication of English names were resolved simply by adding an adjective. The birds of the world include two White Pelicans, two Black Ducks, and two Swallow-tailed Kites. In each of these instances we simply prefaced the name of our species with "American" and, by implication, assumed that our overseas colleagues would use, for example, "African Black Duck."

The British are well known for their insistence on "their" species of a group being *the* Heron, *the* Jay, *the* Wren, etc. Alas, some of this same provincial outlook could be found in the Fifth Edition of the A.O.U. Check-list. The world has more than one Gannet, Pintail, Goshawk, Skua, Roadrunner, Dipper, Mockingbird, and Starling, to mention about half of the "unadorned" names used in the Fifth Edition. All of these now have appropriate adjectives to differentiate them from relatives elsewhere.

In a few instances, the expansion of the geographic coverage brought an additional species of the group into the Check-list area. Thus the Fifth Edition had only a single species called "Turkey." The Sixth Edition includes the Ocellated Turkey of the Yucatán Peninsula, and *Meleagris gallopavo* thus required an adjective. We tossed quite a few around, such as the overused "Northern," but our reasoning was that everybody calls it "Wild Turkey" anyway, so why not go along with that usage?

In general, "appropriateness" or lack thereof has not been used as a sole reason to change a long-standing name for a genuinely North American species. We all know that magnolias are not the typical habitat for Magnolia Warblers, and that Philadelphia may not be the best place to look for Philadelphia Vireos. However, we have made a few changes when the name used was misleading, especially if not well established. When the three "species" of North American flickers were combined into *Colaptes auratus,* the name first proposed was "Common Flicker." However, this species is common only to a North American; other flickers are equally common in South America, so the name has been changed to the geographically accurate "Northern Flicker."

Several species in the Fifth Edition are only peripherally North American, including a number of seabirds and some tropical birds that have penetrated the southern United States. We usually chose the names for such species that are used in the literature of the principal parts of their ranges. "New Zealand Shearwater" was changed to "Buller's Shearwater," which is what New Zealanders call it. "Louisiana Heron" was not discarded because of inappropriateness (although Louisiana is only a tiny fraction of its range), but because the species is called "Tricolored Heron" in most of the English language literature of Central and South America.

A few names have been shortened and simplified, even by as little as a single syllable. "Spot-breasted Oriole" sounds less "stuttery" than "Spotted-breasted Oriole." A pair of awkwardly long names disappears with Short-billed Marsh Wren becoming Sedge Wren, and the Long-billed species retaining the name Marsh Wren.

A major reason for name changes is taxonomy. When two or more species are combined into one, a new name must be found for the collective species. The best known example is the Northern Oriole which is the combined name for Baltimore Oriole and Bullock's Oriole. The loss of the name "Baltimore Oriole" created more tumult than any other change announced in the 1973 Supplement to the A.O.U. Check-list. Yet had we applied this familiar name to the broadened species, think of the confusion that would have arisen with the sudden rash of reports of "Baltimore Orioles" from the Pacific coast!

Left: *American flamingo becomes greater flamingo.* **Right:** *The American kestrel was once inappropriately named sparrow hawk. It eats primarily mice and large insects.* **Below:** *Pintail becomes northern pintail to differentiate it from white-cheeked pintail.*

Esther Schmidt (Valan Photos)

In three instances, the name used for the species outside North America has been adopted for the whole "lumped" species: "American Flamingo" becomes Greater Flamingo, "White-tailed Kite" becomes Black-shouldered Kite, and "Arizona Woodpecker" becomes Strickland's Woodpecker.

Birders have often accused the Committee of eroding their life lists by lumping species. However, we have had to introduce several new English names for the opposite reason—birds formerly thought to belong to a single species that are now considered two species. We are accustomed to the former Boat-tailed Grackle being divided into the Boat-tailed and Great-tailed Grackles, and the division of the former Traill's Flycatcher into Willow and Alder Flycatchers. There are six such "splits" in the Sixth Edition, including the division of the Screech-Owl into Eastern and Western species, and the revival of the Red-breasted Sapsucker as a separate species from the Yellow-bellied.

By my count we have announced 101 changes of English names (not counting changes in hyphenization). In only one case did we introduce a completely new name to ornithological literature. This was done to resolve the conflict between the American and African usages of "White-necked Raven." The "White-necked Raven" of Africa, *Corvus albicollis,* really does have a white neck, whereas the white is concealed in *Corvus cryptoleucus* of the southwestern United States and adjacent Mexico. We felt that because the African bird was conspicuously white-necked, it deserved to keep the name. Somebody proposed that the American species be called "Chihuahuan Raven," and we were delighted to accept this suggestion. The name, incidentally, does not refer to the Mexican state of Chihuahua, but to the Chihuahuan faunal and floral district which constitutes the major portion of the range of this raven.

Will these "new" English names prove to be stable? I have no doubt that they will be as quickly learned as were the new names introduced in 1957. Soon only we old geezers will remember that Americans once called the Red-necked Phalarope "Northern Phalarope." Will there be more changes? Almost certainly. Supplements to the Sixth Edition will probably be published as frequently as every two years. We anticipate, however, that altered taxonomic status will be the principal and perhaps sole reason for changes in English names.

Meanwhile the Committee that produced the Sixth Edition hopes our 20 years of work have resulted in a reference work that both amateurs and professionals will find indispensable. We are well aware that it is not the last word—it is a cliché to mention that a check-list is out of date before it is published. We know of at least one species that has been added to the fauna of the area covered since the Sixth Edition went to press, a South American hummingbird collected in Panama.

The changes in English names and in classification will undoubtedly take some getting used to, but in the long run we hope that they will turn out to be improvements.

FURTHER READING

"34th Supplement to the American Ornithologists' Union Check-list of North American Birds," *The Auk,* vol. 99, pp. 1CC-16CC.

THE AUTHOR

Kenneth C. Parkes is Chief Curator of Life Sciences at Carnegie Museum of Natural History, Pittsburgh, Pennsylvania.

Michael L. Smith

Hans Reinhard (Bruce Coleman Inc.)

View from a Hayloft Aerie

by **Libbie Johnson**

Imagine birding through the lower section of bifocals! Libbie Johnson takes a close look into the nesting habits of the swallows in her horse barn.

I BACKED INTO ORNITHOLOGY through the barn door. I had been a bird watcher, roaming fields and woods, frequenting beaches, and traveling afar, binoculars at the ready. The move from casual watcher to bird-blind sitting and note taking came about on a cold windy morning in late April, 1979.

I had gone to the barn one morning to feed the horses. Shivering, I mounted the steps to the loft, intent on throwing down hay. A faint chittering rose above the stomping and snorting of the hungry animals. Two barn swallows, the first of the year, sat huddled on a crosstie, feathers fluffed. Here I stood freezing after walking 35 yards through bitter winds, yet they had made it to the same barn from South America, surviving storms in nothing but their feathers. By the time I returned to the kitchen I was asking myself questions about why the swallows came back to my barn in Princeton, New Jersey.

Our farm, with buildings that go back 150 years, has been hospitable to a long-established colony of barn swallows. Their adherent cup nests are plastered atop beams and onto crossbraces, joists, and rafters. Doors sagging on weary hinges hang ajar to bid them welcome to the haylofts. The barns stand near a country road, and while the utility lines are bothersome aesthetically, they are easy perches for the small feet of the adults and their fledged young. The birds, lined up like so many clothespins, have a view of the hayfields and pastures over which they search for insects.

Now I wanted to know exactly when the swallows arrived, how long they stayed, and how they refurbished old nests or constructed new ones. Each answer brought new questions and four years later I am still asking them. But, after 228 hours photographing and observing two different nests and three swallow families, several thousand slides, and pages of notes on mud gathering, nest building, tending and feeding, I have some answers too.

Because photography is my husband's avocation, for me to think of studying a bird is to use a photographic approach. I sought Dave's help with what I envisioned to be no more than a photographic essay. Spring of 1979 was a period of many ifs. If the birds returned to the nest on the inside wall of one of the barn stalls, I would have the ideal angle for photography. If they returned we would need to mount camera and photographer close to the nest. We gambled on the swallows' return and built a platform six feet above the floor of the stall. Next Dave mounted tripod, camera, and lights, all the time wondering if the birds would tolerate the flashes. Using wornout sheets I fashioned a blind atop the platform and waited to see if the swallows would accept the paraphenalia.

Sure enough, the swallows came to the stall and though they stared and chittered at the strange arrangement, they claimed the nest. Each morning Dave loaded the camera and all I had to do was activate the flash and snap the pictures. The first questions I wanted to answer were if swallows survived the long migration, did they come back to the same nest each year? Did the young return to where they fledged? Reports indicated that at least one of the pair often returned to the same nest, and that the young returned to the area. But I wanted to see for myself and banding some young seemed the simplest way to begin.

My search for a banding authority turned up Hannah Suthers, a research assistant in biology at Princeton University, and president of the Eastern Bird Banding Association. That year we banded only 19 young. This was not an auspicious beginning and I wondered how we could see the tiny bands once the birds were perched on the nearby wires, hunkered down on their weak legs and small feet with nary a band visible. Swallows need strong wings to pursue airborne food rather than strong legs for perching upright and displaying numbered bands.

By late summer, when the swallows were massing on power lines readying for their trek southward, I was planning the next swallow season. I wanted pictures of swallows gathering mud and to be able to look directly into a nest—to be even closer than my platform four feet from it.

On April 18 of the following spring the swallows began to arrive. In three or four days the utility wires and top rails of the barnyard fence were pressed into service as mating grounds, the birds close together, sometimes rubbing heads and necks or touching bills before copulating. Nest selection was under way and building would soon start.

Leonard Lee Rue III

The only way to get mud-gathering pictures was to create a mud puddle at a good spot on which to train the camera. It was simple to let the old iron tub used as a watering trough overflow. The swallows wasted no time claiming it and never minded the horses that walked by on their way to the trough. Cats sent the birds into a swooping, chittering frenzy, dogs and humans sometimes disturbed them, but the horses could sneeze, snort, and stomp, yet birds in nearby nests didn't bat an eye.

The birds' routine for mud gathering was to land in the barnyard, pick up several pieces of straw in their bills, then fly to the puddle and gather mud with thrusts of their beaks opened just far enough to take in mud without dropping straws. Sometimes a pair would fly away in tandem; other times one would pause and wait for a turn to

Left: *Young barn swallows wait to be fed.* **Right:** *Barn swallows are the only North American swallow with a deeply forked tail.*

lay down an oozing building block of mud and straw on the chosen nest. I observed a pair work for an hour, take a half-hour break, then gather mud again.

According to Arthur Cleveland Bent in *Life Histories of North American Flycatchers, Larks, Swallows and Their Allies*, authorities differ as to how swallows carry mud. My swallows carried it in the throat and mouth. I have seen birds push their beaks into mud as many as 14 times before flying away, throats and mouths bulging. Rarely was there a small deposit of extra mud rolled atop a bill as some observers have noted.

To get even closer to the birds than I had been the previous year, I chose a different nest for observing and photographing. This one, plastered to the side of a ceiling joist, had been a favored nest for years and chances were good the birds would return to it.

Right on schedule a pair of swallows began to stand on the edge of the nest. We fashioned a hatch on the hayloft floor boards directly above the nest through which I could observe and Dave could photograph the birds. They didn't seem to mind my watching so long as I was covered with a huge swatch of black cloth. Occasionally the birds would land on the nest, pause, cock their heads, and peer at me with black eyes as bright as beads. I was so close to them I had to put on my reading glasses to focus. Imagine birding through the lower section of bifocals!

Refurbishing the barn swallows' nest of mud and straw requires frequent visits to mud puddles. The mud is then carried in the bird's throat and mouth. Mud may also be pushed onto the top of the bill.

Both photos by Dave Johnson

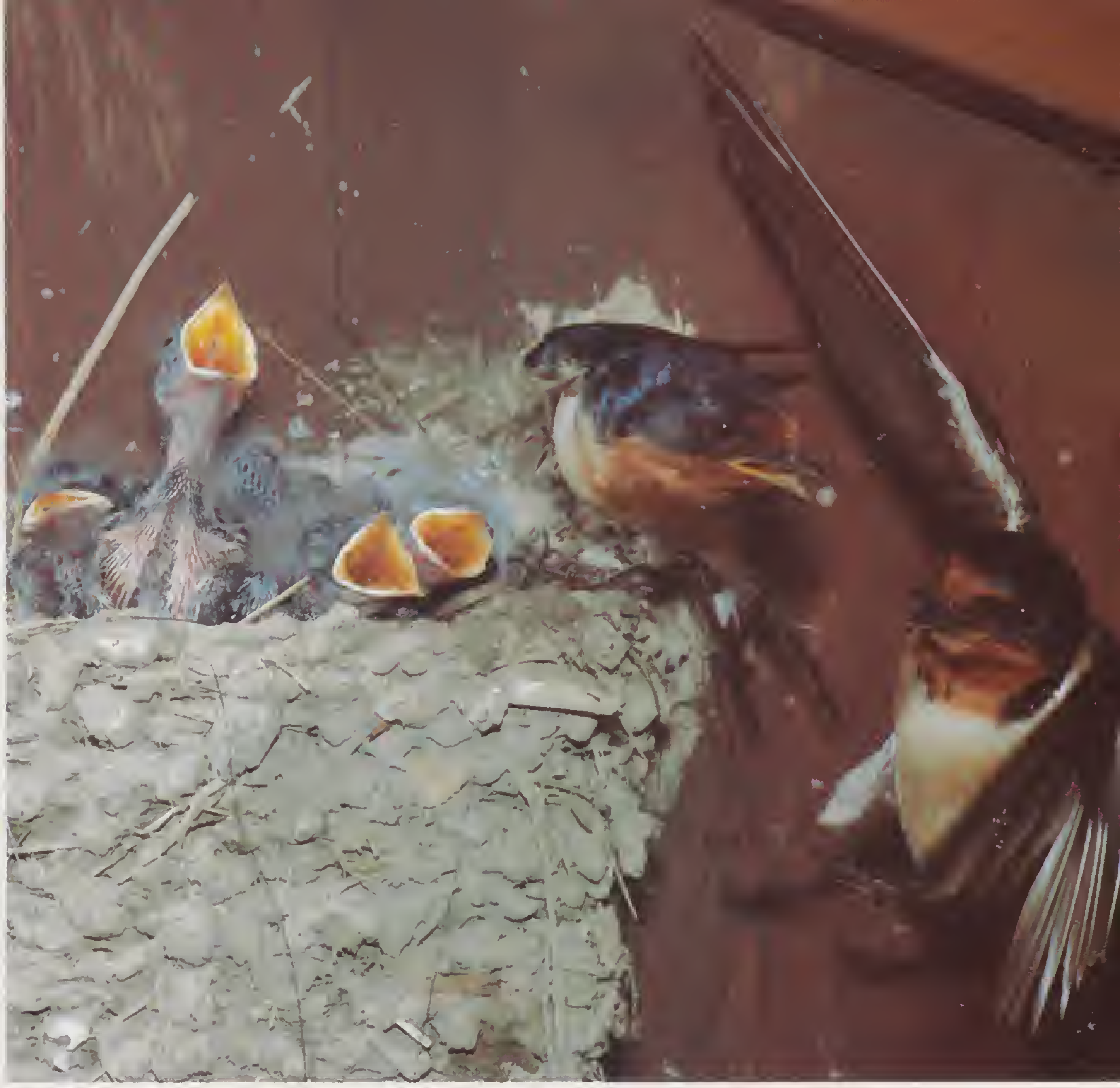
The view from my darkened hayloft aerie was magnificent. I was able to see the pronounced difference in coloring of this pair; the throat and forehead of the male were a much darker rust than that of the female. I observed the final steps in the mud-gathering process. They did indeed approach the nest in tandem, one perching on the rim of the nest while the partner finished placing its burden. Most often they brought a combination of mud and straw.

I could see the throat muscles contract as an amazing amount of semiliquid material spilled from their triangular bills. One time they would deposit the mixture along the rim of the cup, another along the back where the nest was anchored. Or the mud might be placed in a back corner; although the nest appeared elliptical from below, looking into the cup I could see the birds kept it round inside by packing mud into the back corners.

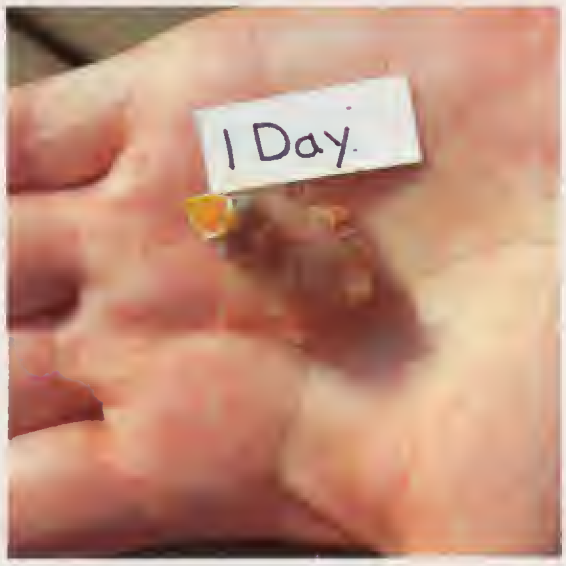
I observed their technique for creating the springy, cradle-soft center of the nest. After each new layer of mud-and-straw blocks was laid, the birds would bring loose, clean straws and drop them across the nest not bothering to tuck the ends into the mud. No need to, for once the next blocks were started, they automatically covered the ends of the straws, anchored them firmly, and left the middle of each straw riding free. Throughout the building process the female turned around in the nest, tamping the material with her feet and smoothing it with her body.

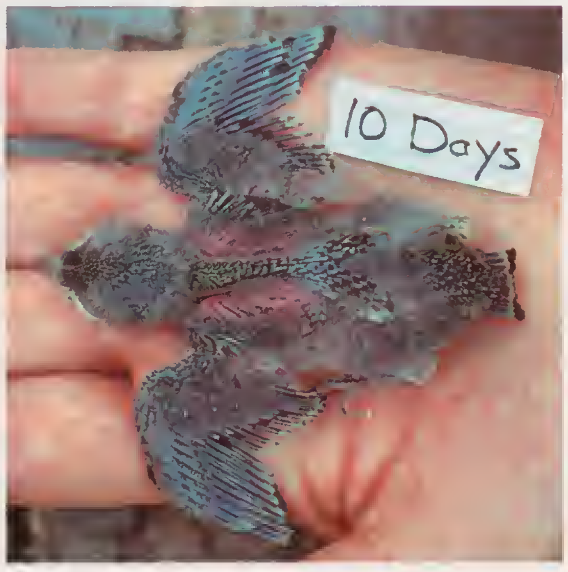
On May 14, I noticed the female perched on the barnyard gate with two white feathers in her mouth, framing her face in a "v." I raced up to the loft and climbed under my black canopy in time to see her fly in and place the feathers in the nest. She made quite a ceremony of tucking them in with the other feathers, then she flew off with a two-note call which was answered by her mate from the telephone wire.

The egg laying began the following day. As I had observed the year before, the eggs were usually laid by 7 a.m. She would settle down in the nest while her attentive mate flew in and out. She would rise and strain and look beneath to see if an oval white egg spotted with brown had fallen into place. The task accomplished in several minutes, she rose, dropped off the nest, and flew out, the male in pursuit. The day the



Above: *Adults relay food to their chicks.*
Right: *Chicks in two stages of development.*





Three photos by Dave Johnson

fifth and last egg was laid the female began to incubate.

My hayloft aerie was not good for observing the sharing of the incubation duties. While the birds had not minded me in their frenzy of nest building, now that they were sitting on the eggs they were all too aware of my presence and would cock their heads at me and fly off, so I had to stop. Once the eggs had hatched and the birds were into their brooding duties, however, they were too busy to notice me.

I watched for an hour the first day after the five eggs had hatched. The scarlet, naked creatures were altricial young all right, and needed attention. Their eyes were not open, they had no claws and only a few puffs of grayish natal down. There was only occasional feeding during this period; I was unable to see what the parents bore in their beaks, but no doubt they had small insects for small mouths. The female took longer turns at keeping the young warm than did the male. While he merely perched low, she settled down over them.

Each day brought phenomenal development in the nestlings: tiny claws, pinfeathers, opened eyes, and soft cheeps. By the 13th day they were stretching their wings, and by the 17th they were preening.

At 5:30 a.m. on the 19th day a sense of urgency pervaded the barn. I heard a whirr of wings as one nestling stood on the edge of the nest revving up its motor. Moments later another hovered above the nest like a helicopter then lowered itself to the pad. Soon all five were awake and stretching, bumping into one another and flying in place. Suddenly one perched on the rim, fluttered for a moment and flew off. A second bird followed. The parents were wild with attention to the fledglings and the air resounded with two-note calls. The three unfledged young settled into their more roomy nest. The female returned to feed them. The male brought food to the two who had landed on the nearby telephone wire.

By 11 a.m. the last three young fledged. One flew straight out the door to the telephone wire, the other two to pegs on the barn walls for a brief stay and then out into the world. So ended my second year of observation. During the third year I would watch feeding behavior.

I had noted so much variation in number of feedings per hour that I realized only a day-long count would be valid. In my counts of the previous year, for instance, I had kept a record from 5 a.m. to 9 p.m. one day and found that the parents had fed 462 times. But they fed as few as 10 times between 5 and 6 a.m. and between 11 a.m. and noon, and as many as 46 times between 3 and 4 p.m. and 7 and 8 p.m. Trying to project a day's feeding schedule from a few hours had no merit. Only a full day of observation would tell the story.

In addition to counting the feedings, I wanted to observe how the parents shared feeding duties. For this I had to be able to distinguish readily the male from female. In *North American Bird Banding Manual* the bander is advised that the male has "unsheathed outer tail feathers 83mm or more," and the female has "unsheathed outer tail feathers 74mm or less." I defy anyone to detect nine millimeters of difference in the length of two feathers on moving swallows. Identification of male and

Brian Milne (Valan Photos)

This newly fledged barn swallow has a lot to learn before embarking on its journey to South or Central America where it spends the winter.

female would depend on a foolproof system of marking so I could sit in a blind and distinguish each bird as it swept in.

I came upon such a system with help from ornithologist Meg McVey who at the time was attending Rockefeller University. She had been studying a barn swallow colony and devised a marking system which consisted of a long white mark and a combination of dots painted on the three outer primaries of each wing. She had found that yellow and white worked best and that when the bird came to rest the colors were easy to see.

Hannah Suthers applied to the U.S. Fish and Wildlife Service Bird Banding Laboratory for permission to mark my birds. By early spring permission was granted but it was May 22 before Hannah and I succeeded in netting the male. I had been fearful of scaring off the birds until the eggs were laid and the parents were committed to the site. I hoped to catch the pair but the female escaped. With only one bird in hand there was no need for a code system, so we marked the male with a long slash of white paint on three wing feathers. When we released him, he flew to join the chirruping female on the telephone wire. He was readily distinguishable from her both in flight and when perched.

I spent 76 hours in a blind only six feet from the nest, most of the time in all-day sessions. The male was a relief sitter on both eggs and young, willing but edgy. I observed the female sitting on the eggs for as long as 30 minutes a stretch, occasionally standing to turn the eggs with her bill; the male usually sat only a minute or two and rarely looked comfortable.

The same pattern held for keeping the young warm. The female would settle over them for 11 or 12 minutes while the male stayed only a minute or two. He hadn't abandoned his familial duties; he was an avid nest cleaner and dispatcher of cats, dogs, and the occasional swallow that strayed too close to the nest.

While the male worked hard at feeding the young, he never equaled the female and seldom fed more times in an hour than she. I say this after observing them for 56 hours in stints of 13, 14, 12, 6, and 11 hours. During those hours he fed 442 times, she 629.

I could never have logged all these hours if Dave had not served me breakfast in the blind and come home at noon to give me a lunch break, he all the while jotting down feeding trips and behavior patterns.

While I sat in the blind listing and listening, I was already planning the next swallow season. Two hundred twenty-eight hours of observation were but a beginning. The same was true of 66 banded young. So far none has returned, but someday one will come back from South America. I will net it, check the band number, and find that its home is in our barn.

FURTHER READING

Roth, Charles E. *The Wildlife Observer's Guidebook.* Prentice-Hall, Inc., Englewood Cliffs, New Jersey. 1982.

THE AUTHOR

Libbie Johnson has published two adult and six juvenile books, short stories, and travel articles. She also writes on ornithological subjects.

RESEARCH & REVIEW

by Richard E. Bonney, Jr.

Food Limitation

Birds need food, water, cover, and space to survive. Many bird ecologists believe that of these resources food supplies play the greatest role in limiting the size of bird populations. These ecologists suggest that competition for food determines the numbers and kinds of bird species present in a given area. Others argue that more food is available than is eaten, and that food plays only a minor role in regulating bird populations.

Proof that food is or is not limiting is extremely difficult to obtain. It requires detailed knowledge of the food eaten, food available, and the energy requirements of every bird species present in a given area. This task may be possible, but it has not yet been completed by any researcher. In the meantime, we must examine the importance of food as a limiting factor by other, less definitive means.

For example, John B. Dunning, Jr. and James H. Brown of the University of Arizona have discovered that the numbers of several kinds of sparrows wintering in southeastern Arizona grasslands and deserts are dependent upon food supplies ("Summer rainfall and winter sparrow densities: a test of the food limitation hypothesis," *The Auk*, vol. 99, pp. 123–129).

Dunning and Brown examined relationships between the density of 10 species of wintering, seed-eating sparrows and the amount of rain that had fallen the previous summer. Earlier studies have shown that the more rain, the greater the number of seeds.

To estimate sparrow abundance, Dunning and Brown tapped the annual Christmas bird counts sponsored by the National Audubon Society and published in *American Birds*. These data provide reasonably reliable population estimates. For their analysis, Dunning and Brown used yearly data from five separate Christmas count areas that included arid grassland and desert habitats. Data on summer rainfall were obtained from reports of United States Weather Bureau stations located within the five count areas.

Dunning and Brown subjected their data to several statistical tests and concluded that the number of wintering sparrows was highest during years of highest summer rainfall at four of the five count areas. They also discovered that a good year for one species was a good year for all.

The researchers feel that their analyses provide support for the proposition that local abundances and distributions of seed-eating birds, at least of sparrows in southeastern Arizona, are regulated primarily by the availability of food. Could the increased numbers of sparrows be related to some factor other than food? The most obvious possibility is cover. However, Dunning and Brown feel that cover is of small importance to these wintering birds which forage in open areas.

Other studies have shown that several of these sparrows overlap in their food preferences. Therefore, competition for the limited food supply almost certainly occurs. Do outcompeted sparrows switch to less-preferred seeds? Are they forced to move? Do they perish? Or, as many ecologists believe, has competition caused species to evolve diets and feeding behaviors that minimize competition?

We may never be sure. Each study, however, brings us a little closer to understanding the total picture of bird ecology.

Do Not Disturb

Avian researchers face the possibility that their activities may affect the birds they study. This is particularly true where young birds are handled to assess growth and development. Does handling influence behavior, growth, or survival of the study birds?

There is no simple answer. Bird responses to human disturbance vary among species and even individuals of the same species. Still, any data addressing this question are useful, such as the findings of Katharine C. Parsons and Joanna Burger of Rutgers University, who examined the effects of human disturbance on nesting black-crowned night herons ("Human disturbance and nestling behavior in the black-crowned night herons," *Condor*, vol. 84, pp. 184–187).

Parsons and Burger worked in a 58-nest heronry on Dead Neck Island, off Cape Cod, Massachusetts. Here they studied 26 newly hatched young that were interspersed randomly through the colony. The young were divided into two groups, "experimental" and "control" nestlings.

During the first three weeks after the birds hatched, the researchers entered the colony every other day. All the adults temporarily abandoned their nests while the researchers moved about the colony, systematically ignoring the control birds and handling (marking and weighing) the experimental chicks. Typically, the ignored controls froze as the researchers passed. In contrast, handled experimental chicks greeted the researchers with defensive postures—gaping, lunging, and feather- and wing-raising—as well as vocalizations.

At the end of this period, Parsons and Burger observed the behavior of all 26 chicks during a several minute "disturbance" where the researchers stood by the nest tree, parted the branches, climbed the tree, and captured a chick. During this disturbance, the 12 handled experimental chicks all remained in their nests. All 14 of the ignored control chicks, however, left their nests; two actually leaped from the tree.

Apparently the experimental birds had become accustomed to the researchers' intrusions. The ignored control chicks, however, were traumatized by the invasion and left their nests. Premature fledging can be fatal to a young bird if it encounters an unfriendly adult or if it becomes lost and cannot find its nest.

These results suggest that occasional disturbance to a nestling heron may be more harmful than systematically repeated disturbance. However, caution must be taken in relating these findings to the behavior of other species.

Copycat Birds

Each spring brings a rousing bird chorus as amorous males announce their breeding intentions. Some are singing to prospective mates, others are warning competitors to keep their distance. To the birder it all sounds beautiful, yet beneath the pleasing trills, warbles and whistles may lie an element of deceit. Consider the indigo bunting.

This member of the finch family is one of several species in which individual birds sing their own personal variations of the species' song. A keen-eared birder can distinguish between individual buntings, and the birds themselves recognize each others' songs. Sometimes, though, a bunting may imitate or "match" a neighboring bunting's song. Robert B. Payne of the University of Michigan has examined the relationships between song matching and bunting breeding success and concludes that young birds probably match the songs of their older neighbors as part of an avian con game

("Ecological consequences of song matching: breeding success and intraspecific song mimicry in indigo buntings," *Ecology*, vol. 63, pp. 401–411).

Payne studied indigo buntings during three breeding seasons in southern Michigan. He attempted to capture, mark, map, record the songs, and determine the age and breeding success of all buntings present on two large study areas. When his field research was complete, he had more than 400 song recordings which he analyzed for instances of song matching.

Payne discovered that breeding success of male indigo buntings varied in relation to age. On the average, adult buntings two years of age or older were more likely to have a female and a nest, and fledged more young than one-year-old (first-year) males.

There was, however, marked variation in the breeding success among first-year males. Nearly half matched the song of an adult neighbor. These song matchers were twice as likely to fledge at least one young as the remaining half that did not match an adult neighbor's song.

Of this remaining half, some matched songs of other first-year birds (young-only matchers). Others matched songs of adults that were located some distance away (remote matchers). Others sang only their own, individual song (non-matchers). Young-only and remote matchers were only slightly more successful breeders than non-matchers. This led Payne to believe that increased breeding success of song-matching birds is limited to those territorial birds that match the song of an adult and stay on a territory near the adult.

Does song matching itself increase the birds' reproductive success or are other factors involved? Payne examined relationships among the buntings' breeding success and four other factors: body size, date of arrival on the breeding ground, breeding habitat occupied, and plumage color. (Adult male indigo buntings are virtually all blue, while first-year males range from brown to blue.)

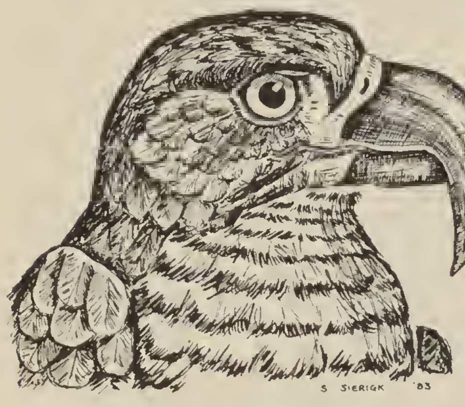
Of these factors, only plumage color could be linked to breeding success—the blue first-year birds were more successful than their browner counterparts. However, the effect of plumage color on breeding success was independent of song matching; song matching increased the success of both blue and brown birds. But how?

Here is where deceit comes in. As males establish and maintain territories, they may avoid territories where they associate a particular song with an earlier defeat in a boundary dispute. Payne feels a young bunting that matches an adjacent male's song is mimicking that adult in an attempt to keep other males away.

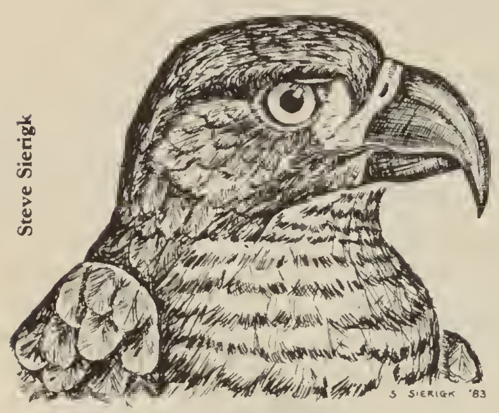
The observation that blue song matchers were more successful than their browner counterparts lends support to this idea; the mimic that was more successful in his strategy of deceit not only sounded but looked like his adult neighbor.

If song copying has such a dramatic effect upon bunting breeding success, why don't all first-year buntings copy their adult neighbors' song? One possibility is that matching behavior is inherited. However, Payne's earlier studies have shown that all first-year males are capable of copying an adult neighbor's song. Payne feels the difference in breeding success of song-matching and non-matching buntings is not genetic, but a result of individual experiences. Exactly what these experiences may be remains to be discovered.

Snail Extractors



This unusually curved and specialized bill developed to extract snails from their shells.



Hook-billed kites with different sized bills do indeed eat different sized snails.

Steve Sierigk

The hook-billed kite, *Chondrohierax uncinatus,* is an unusual bird of prey found in South and Central America. It feeds almost exclusively on tree snails which it extracts from the shell with its specialized bill. But neighboring hook-bills of the same sex and age often have extremely different-sized bills.

Thomas Bates Smith and Stanley A. Temple of the University of Wisconsin recently explored this phenomenon. They began by examining and measuring the bills of 358 museum specimens of hook-billed kites that had been collected in nine geographical regions ("Feeding habits and bill polymorphism in hook-billed kites," *The Auk,* vol. 99, pp. 197–207).

Smith and Temple discovered that specimens collected from two of these regions were small billed and showed little variation in size. In the other seven regions, however, the range of variation was extreme. Some specimens from Peru had bills that were three times as large as those of birds collected in the same area at the same time.

Earlier studies have shown that bill size is sometimes related to the size of food items eaten by birds. To examine this possibility, Smith and Temple obtained data on the sizes of snails eaten by observing hook-billed kites in the field and by collecting broken shells beneath perches. They also determined the sizes of snails available to the kites by collecting live snails and empty shells.

Smith and Temple discovered that bill size was closely related to the sizes of snails. For example, in Tamaulipas, Mexico only small snails were available and only small-billed kites were observed. In contrast, in Colima, Mexico, both large- and small-billed kites were observed and two distinct sizes of snail were available. Field observations, although few in number, verified that kites having different sized bills fed on different sized snails.

Could small-billed and large-billed kites be two separate species? Smith and Temple feel it is unlikely; the two types of kite cannot be differentiated by plumage, vocalization, or habitat preference. Neither do the researchers believe that the two types of kite represent different subspecies, as subspecies do not occur together in the same portion of a species's range.

Instead, Smith and Temple speculate that all hook-billed kites are one species, derived from a common ancestor with a uniform bill; once the species developed its specialized method of snail extraction, natural selection led to a variety of bill sizes suited to the variety of snail sizes. In this way the species could exploit a broader range of snails, thus partitioning resources to reduce within-species competition.

Resource partitioning often occurs among species, between males and females of the same species, or different aged birds of the same species. But, if Smith and Temple are correct, this is the only known case of a species partitioning resources by means of a physical characteristic not related to sex or age.

NEWS & NOTES

Dear Member:

The British Trust for Ornithology (BTO) has been gathering information about bird populations, migratory habits, and the changes birds have undergone over many decades. Thanks to voluntary efforts of its several thousand members, a picture of the ecology of British birds is emerging. The centralized collection of information enables biologists like Raymond O'Connor, director of BTO, to describe the reproductive success of British songbirds, as he did in the Summer, 1982 issue of The Living Bird Quarterly.

The task of developing a picture of how bird populations are changing in the United States, with a land area of more than 35 times that of Great Britain, is challenging. Pioneering work has been done by Chandler Robbins and the staff of the Migratory Bird and Habitat Research Laboratory of the U.S. Fish and Wildlife Service in developing the North American Breeding Bird Survey. Annual Christmas bird counts and surveys of breeding and wintering bird populations have been sponsored by the National Audubon Society. We maintain a Nest Record Card Program, modeled after BTO efforts, and manage the Colonial Bird Register in cooperation with National Audubon. Many states are undertaking or have concluded breeding bird atlases also modeled after similar British projects.

Like the British, we are fortunate to have many volunteer cooperators. We have, however, no centralized, computer-based information processing system to store and interpret continent-wide and regional patterns. The Laboratory's Cooperative Research Program is moving in that direction and has the potential to become a major resource for studying North American birds. Many of the essential elements already are in place. Volunteer cooperators are willing to help; over 2,000 volunteers contribute information. We have the resources of a major university computing system and many methods for statistical analysis.

All we need is to find a way to enlarge our computing facilities, office space, and technical staff. The need is urgent if we are to understand our North American bird populations well enough to assure their preservation.

CHARLES WALCOTT, *Executive Director*

The Laboratory's Library of Natural Sounds (LNS), which has over 40,000 recordings of more than 4,000 species, is one of the most heavily used ornithological collections of its kind in the world. Recently the Kiwi Shoe Polish Company requested tapes of kiwi sounds for possible use in a future advertising campaign. And Mattel will be using, as part of a programmed activity for its Teach and Learn Computer, the sounds of a white pelican from the LNS collection.

Hawk Mountain Sanctuary Association announces two tours of outstanding raptor areas. The first is September 16 to October 2, 1983 and is to Gibraltar and the Bosporus for fall migration. One week is spent at each site. Over 35 species of raptor may be seen, nine eagle species, including the Spanish imperial eagle. The second tour, April 8 to April 22, 1984, covers the raptors of Israel. See over 30 species of raptor; Elat, where almost a million raptors pass every spring; nesting lammergeiers, Barbary falcons, Bonelli's eagles. Both tours will be guided by raptor expert Bill Clark. For more information write to Hawk Mountain Sanctuary, Route 2, Kempton, Pennsylvania 19529.

Are you a birder who can't hear birds well? An audiologist has expressed an interest in developing a "black box" that would dramatically improve this hearing. If you are interested in learning more, please write to Charles T. Clark, Star Route #1, Box 442-D, Rockport, Texas 78382.

The American Ornithologists' Union will celebrate its centennial in New York City September 26 through October 1, 1983. Most functions will be held at the American Museum of Natural History, Central Park West at 79th Street. The public is invited. At the time of the meeting the museum will be displaying "A Celebration of Birds—Louis Agassiz Fuertes and His Art."

Readers have been asking us what those bluebirds on page 19 of our last issue are doing, all huddled together. In the photograph about 14 adult eastern bluebirds are crowded into a hollow log box on a very cold night. Bluebirds often roost in this manner during severe winter weather. Their body heat keeps the interior of the box relatively warm, thus reducing the danger of the birds perishing.

We regret to report the passing of Donald S. McChesney (1895–1983). Mr. McChesney's association with the Laboratory of Ornithology pre-dates his appointment in 1958 as a charter member of its administrative board. In 1976 he was appointed an honorary member.

Assisted by his wife Marion he devoted much time to sound recording and filming of birds in North and Central America, Africa, and England on behalf of the Laboratory. In 1956, 1957, and 1967, he helped to sponsor expeditions to East Africa out of which "More Voices of African Birds" was produced. Beginning in 1958, he recorded and photographed waterfowl in Slimbridge, England; District of Keewatin in Canada, and in Louisiana. In addition he worked in Central America with Wesley Lanyon of the American Museum of Natural History on the sound recording and filming of flycatchers and, in 1965, he co-authored an article in *The Living Bird,* "Sound Production in Two Species of Geese."

We will miss his unstinting and enthusiastic support.

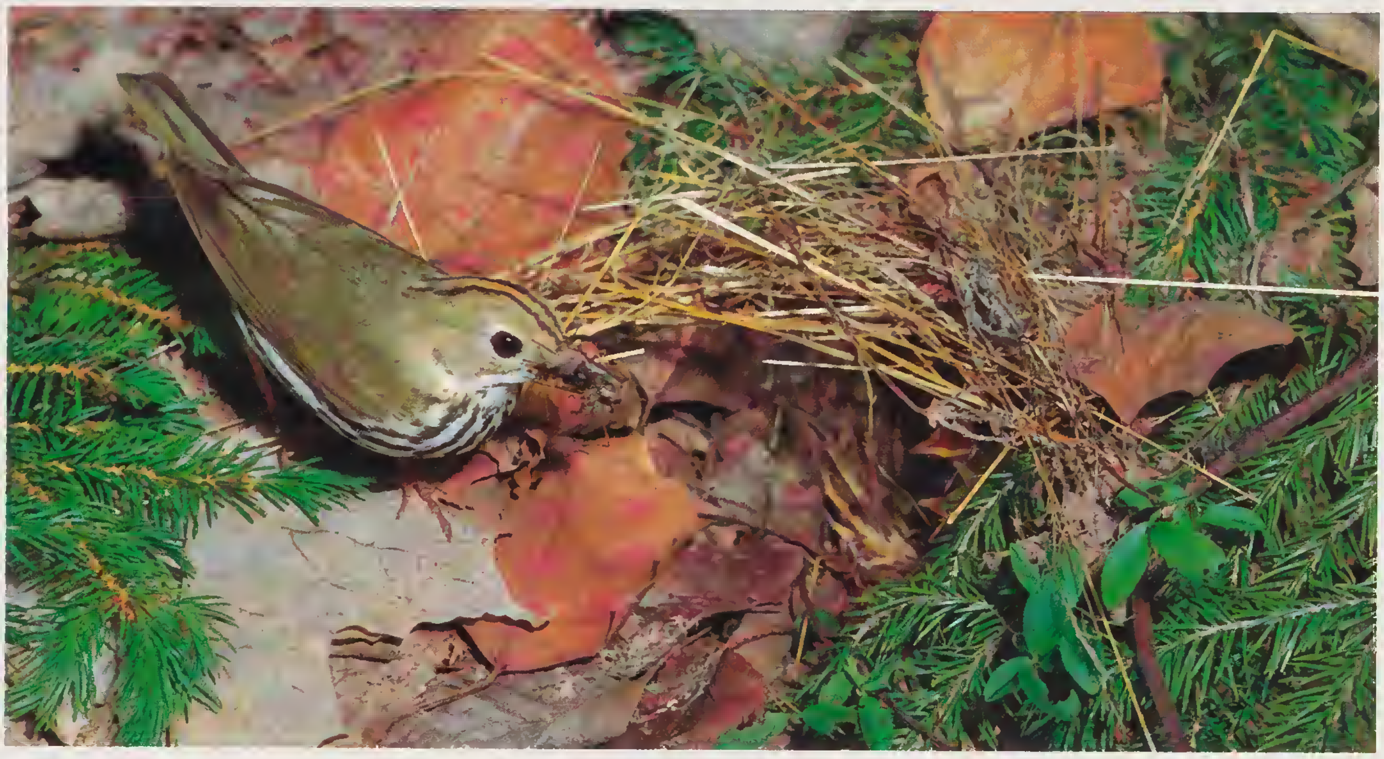
Paintings, decoys, quilts, and soft sculpture have been donated to the Laboratory for sale at our October auction to raise funds for our new Avian Rehabilitation Center (ARC). Plans for the Center were kicked-off by gifts from Cornell alumnus Richard T. Cliggott and The Peregrine Fund. Proceeds from the auction will fund the new aviaries for the care of injured birds. To obtain a program of the auction write to ARC, Laboratory of Ornithology, Sapsucker Woods, Ithaca, New York 14850. Or call (607) 256-4319. Bids will be accepted by phone or mail.

Kenya Tours—The Laboratory of Ornithology, Ithaca, and the Academy of Natural Sciences, Philadelphia, are co-sponsoring three 21-day safaris to Kenya. The aim is to explore the ecology and culture of East Africa, including its remarkable birdlife. Tours are scheduled for November and December, 1983, and January, 1984.

The expedition leader is Alec Forbes-Watson, a former Kenya game warden and head of the anti-poaching unit, now a staff member at the Academy. Each group also will be accompanied by an experienced photographer from the Laboratory.

For more information call David Blanton (607) 256-4017 or Alec Forbes-Watson (215) 299-1069.

A Study in Nesting Diversity



article and photographs by **Hal H. Harrison**

What do a hummock of sphagnum moss, a jack pine forest, festoons of old man's beard lichen, and the woodland floor have in common? They all provide sites for those diverse nesters, the wood warblers.

"CONFUSING fall warblers" is a term used by bird watchers throughout the United States and Canada. It describes the hordes of wood warblers that annually migrate south, many of which display plumage changes that are startlingly different from the brightly colored birds of spring.

Much less apparent and overlooked by many who are fascinated by the 53 species of warblers that nest north of Mexico is the fact that the nests and nesting habits of many may be just as confusing as the birds themselves.

To the tyro the common name of the family, wood warblers, could be misleading. The novice birder would hardly associate a wood warbler with a dry, barren desert wash, yet Lucy's warbler finds this habitat ideal for its grassy nest within a mesquite cavity. Nor do high mountain peaks come to mind when one thinks of warblers, but the olive warbler is at home at 12,000 feet in Arizona's pine forests. A pocket in a hummock of sphagnum moss is often home to a Canada warbler, and beneath an upturned root in an alder swale is where a northern waterthrush nests.

Warblers choose varied and specific sites for their nests. To look anywhere but high in a pine tree for the nest of a pine warbler is usually futile. The pine warbler is not unique in its affinity for one type of vegetation for its nest. Probably best known for its insistence on a particular habitat is Kirtland's warbler. Its demand for a jack pine forest of trees six to 18 feet high, eight to 20 years old, with heavy ground cover has been a puzzling phenomenon for years. A surprise is that Kirtland's does not nest in the jack pine trees; it nests on the ground under or near them.

Not so well known but just as insistent upon the right nesting trees is the golden-cheeked warbler of central Texas, mainly the Edwards Plateau. This close relative of the black-throated green warbler commonly nests on the horizontal limb of a mature Ashe juniper and the exterior of the nest is constructed of gray cedar bark. All nests I have found were well hidden in leaves and twigs.

A classic example of a species determined to use the same kind of nesting site wherever possible is the northern parula. I have observed this species from the live oaks of Florida to the foggy spruce forests of coastal Maine, and I have yet to find a parula that did not nest in Spanish moss in the south or in festoons of old man's beard lichens in New England. In between, where neither the moss nor the lichen occurs, parulas seem to be at a loss to know how to build a nest and where to place it. In this situation nests are crude and

Above: *On the woodland floor an ovenbird's nest is concealed by its surroundings.*
Right: *Black-throated blue warbler nests close to the ground in low trees and shrubs.*

trashy. The most unusual I ever found was in West Virginia where a pair of parulas nested in a piece of burlap dangling from the branch of a hemlock tree.

The proclivity of Lucy's warbler for a desert nesting site is not this species's only bid for individualism. It is the only wood warbler in the western United States that builds its nest in a cavity. Most nests I have found have been in natural cavities, but Lucy's will also inhabit old woodpecker holes, build under loose bark, or occupy deserted nests of verdins.

Among warblers only the prothonotary, which nests in the eastern United States, shares the hole-nesting habit with Lucy's. This species, however, is as attached to a wet climate as Lucy's is to an arid one. Observers report that most nests are built in cavities over water. The prothonotary is much more of an opportunist than Lucy's, accepting what is available. Usually nests are placed in natural cavities, woodpecker holes and bird boxes, but the following nesting sites have been reported: on a shelf inside a shed, in a paper bag partly filled with staples, in a coffee can, a tin pail hung on a porch, an old hornet's nest, a tin cup in a barn, and an upright glass fruit jar in a houseboat. Amazing is the pair that built its nest on a ferryboat in daily operation in Mammoth Cave National Park and another pair that placed its nest in a tool box on a log loader in operation along the Mississippi River. The tool box was used successfully two years in succession.

While observers of the American redstart and common yellowthroat might disagree, I believe that the yellow warbler may be the best known wood warbler in our country. It is the one species that nests close to inhabited areas, particularly in yards that offer cover of multiflora and other rose bushes. Nests of the yellow warbler and redstart are quite similar in appearance but the latter's nest is neater in construction and has thinner walls.

Millions of warblers in northern United States and Canada are attracted to evergreens as nesting sites: spruce, fir, hemlock, and pine. At or near the tops of these trees are the nests of Cape May, Blackburnian, and bay-breasted warblers. For me, one of the most difficult warbler nests to find is that of the Cape May. With most warblers you can follow the female to the nest, but the elusive Cape May female has a trick that makes following her almost impossible. She flies to the base of the nest tree and slowly and quietly makes her

(Grant Heilman)

way up through the inner branches until she reaches the nest, which is most often in the crown of a spruce.

The only Cape May nest I was able to study from egg laying to hatching ended in disaster. When the young were five days old and photography seemed possible, a storm destroyed the nest and young. In that same storm I also lost the nest of a Blackburnian warbler in which the young had just hatched.

In the Chiricahua Mountains of Arizona I had to climb 60 feet to reach the nest of Grace's warbler on a horizontal limb of a ponderosa pine. Grace's is another warbler that does not fly directly to the nest. It lands where the nesting limb joins the trunk and then works its way out to the nest through dense foliage.

Two arboreal warblers that would seem to have little in common are the American redstart and olive warbler, but they are alike in that one-year-old males, still wearing plumage that resembles females more than members of their own sex, are capable of securing mates and breeding in competition with rival males adorned in nuptial plumage.

In Barfoot Park high in the Chiricahuas I had two olive warbler nests under observation at the same time. At one nest, the male was a striking adult with orange-brown head and a conspicuous black cheek patch. At the other nest, the male was hardly distinguishable from the nondescript female. Photography at these nests was impossible. Both were very high in ponderosas but more discouraging was that both were far out on horizontal limbs, at least 20 feet from the trunk.

Compared with nesting olive warblers photographing American redstarts is simple. They commonly nest low in deciduous trees. I have been successful in recording the feeding activity of redstarts, including the yearlings. While others have found young males nesting in many areas, I have seen them only in Maine on Mt. Desert Island. Here in the alders, birches, and young conifers, I have found females that apparently welcome the yearlings as mates. At one nest where I spent a day photographing, the female refused to feed the young while my camera was in place, but the young male fed without apparent fear.

With the exception of the parula, the ovenbird is the warbler that builds the most unusual nest. The bird's name suggests the structure. Like an old-fashioned outdoor Dutch oven, the little mound of grass and twigs is open only on one side, usually a mere slit through which the bird can squeeze itself. On a woodland floor, this nest so matches its surroundings that discovery is almost impossible.

Another ground-nesting bird that is a master in hiding its nest is Virginia's warbler, a resident of western mountains of the United States. This nest also has a tiny opening which leads to a grassy structure buried deep in ground litter, but its roof is not elevated above the forest floor like the ovenbird's "oven."

Two very similar species of warblers, also ground nesters, are the blue-winged and the golden-winged. They appear to be engaged in a battle for nesting survival in quite a few areas where ranges overlap. Where studies have been conducted the blue-winged has become the dominant species, replacing the other as the commoner if not the only one breeding in disputed territories.

These species are quite similar in many ways; both prefer woodland edges, openings in deciduous forests, overgrown pastures, stream edges and bottomlands for their nests which are built on or near the ground. Their eggs are similar although the golden-winged female tends to lay eggs more heavily marked than the blue-winged, and both species are attracted to the base of goldenrod clumps as a favorite nesting site.

The nest of the yellow-breasted chat is quite unwarblerlike. It is a bulky structure built of leaves, vines, weed stems, and grasses. It reminds me of a cardinal nest. The chat's eggs are the largest of warbler eggs and the chat's behavior is not very warblerlike. For example, the aerial antics of this species during courtship are not only unlike other warblers but unlike other birds. It is at home in dense, thorny thickets of berry bushes, vines, and rose bushes. The nest may be one of the hardest warbler nests to find. I have been able to find quite a few but, I hurry to add, not without innumerable scratches.

Bogs, swamps, swales, and marshes attract nesting warblers more often than one might suppose. A denizen of remote bogs is the Connecticut warbler which travels each year from the tropics to breed in the vast tamarack-black spruce bogs of Canada and northern Michigan, Wisconsin, and Minnesota. The female sinks her nest in deep moss where it is so well concealed that few have been studied. While the female incubates, the male sings far from the nest and is of no help to the nest hunter.

The northern waterthrush is also a dweller of swamps and swales. Although the female occasionally places her nest in a wet hummock, more often it is hidden among the upturned roots of a fallen tree. A friend of mine, Ralph Long, spent a day searching for the nest of this waterthrush in a Maine alder swale. The birds were close by but neither approached the nest while Long was near. Returning to his camp, Long discovered that he had left his pipe in the swale where he had been sitting for many hours. Returning to the spot, he was startled when a female flushed from an upturned root within four feet of where he had been sitting. The nest, hidden among the roots, contained five eggs.

The following year, I informed Ralph that I would be spending a week in the I'On Swamp on the Fairlawn Plantation near McClellanville, South Carolina, hunting for the nest of Bachman's warbler, one of the rarest birds in North America. He mailed me his pipe with the suggestion that I leave it in the swamp and then go back to retrieve it.

In the I'On Swamp, Arthur T. Wayne found the first South Carolina nest of Bachman's warbler in 1906. In time Wayne found 32 nests in that area, but over the past 46 years not one nest has been found anywhere. (The last nest was found in Alabama in 1937.) Indeed, the bird itself has been seen only rarely in recent years. Incidentally, Audubon named the species for his friend John Bachman who discovered it in 1832 and I learned from the natives in this Carolina low country that the Bachman family pronounced their name "Backman" not "Bockman."

I have made two treks to the I'On Swamp in search of this phantom warbler, and although I never saw or heard a Bachman's, the trips were always memorable. This cypress swamp is alive with birds in the spring. In a 10 minute walk on a dike above the water I listed 19 species I either saw or heard. In that list seven were warblers. The most abundant were the northern parulas that were busily weaving nest pockets in Spanish moss.

As time moves on, the number of nesting species of wood warblers in the United States may increase. Tropical species from Mexico are continually being sighted in Texas and the southwest. A rufous-capped warbler's nest was found in Arizona not long ago. The breeding ranges of some eastern warblers have been moving westward; southern species are reported moving north.

The world of wood warblers illustrates the dynamic nature of birds' distributions and the pervasive influence habitat has upon birds, further underscoring the need for the preservation of habitats and for increased understanding of all birds, even the confusing ones.

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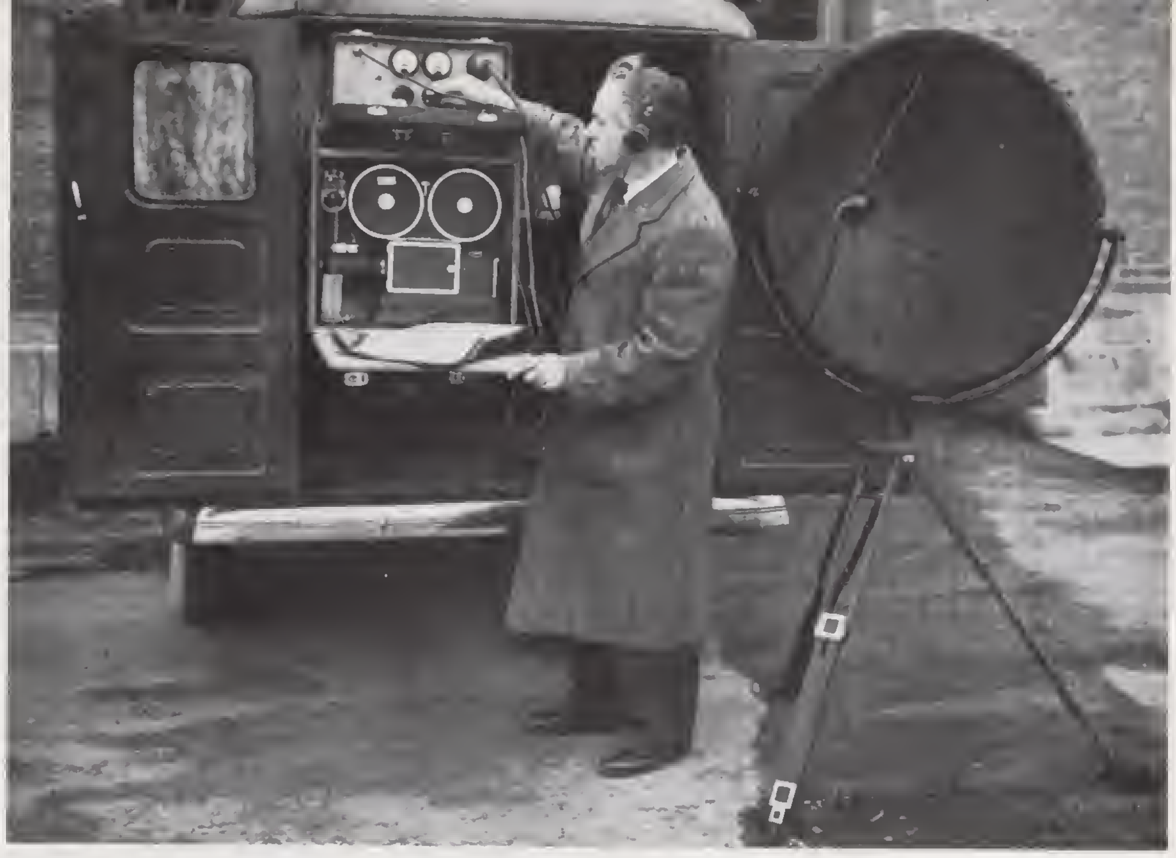
THE AUTHOR

Hal H. Harrison is author of two field guides: *A Field Guide to Birds' Nests* and *A Field Guide to Western Birds' Nests.* His latest book, *Wood Warblers' World* will be published in fall of 1984.

Left: *In New England northern parulas usually nest in old man's beard lichens.* **Above:** *American redstart commonly nests low in deciduous trees.* **Below:** *Lucy's warbler shares its hole-nesting habit with only one other warbler, the prothonotary.*



Peter, Paul, and the Parabola

by M. Peter Keane

M. Peter Keane, director of quality control for Home Box Office, was an undergraduate student in ornithology at Cornell when bird song recording was just beginning. He recalls his part in the birth of the first parabola made for the recording of bird sounds. At left, Paul Kellogg, sound truck, and parabola.

"I WAS FORTUNATE enough to be studying under Dr. Arthur A. Allen when the combined talents of Allen, Albert Brand, and Paul Kellogg were propelling us toward the first breakthrough in bird song recordings.

I took all of Doc's classes. One was an entry level course in bird identification which was taken by many arts and science students. Then there were the professional courses. George Sutton was around for a while as was a graduate student named Pettingill.

As a special project, Doc teamed me up with Albert Brand. The impetus for pursuing the recording of bird song was provided by Albert when he arrived at Cornell in the 1930s. He had been a stockbroker in New York City who, at the age of about 40, sold his seat on the stock exchange, retired from business, and began to study his real passion, nature.

Albert was very interested in birds and a friend of his, Frank Chapman, an ornithologist at the American Museum of Natural History in New York, told him "if you want to learn more about birds, you ought to go to Cornell." Even before he got to Cornell, Albert had heard of Doc Allen. Doc had written books and had gone on successful expeditions.

Albert soon learned the importance of identifying birds through their songs and asked if phonograph records existed. At that time only the Fox-Case Movietone Corporation had a recording of a song sparrow made with the assistance of Doc Allen. Albert then offered to fund and operate a project to record all possible bird songs in the wild.

His first step was to ask for help from a friend in New York City, David Sarnoff, chairman of the Radio Corporation of America (RCA). When Albert explained his project, Sarnoff proposed that Albert bring the birds into his recording studio—not very practical. Albert then found an electronics engineer who built an amplifier he thought would be powerful enough to record bird songs. Encouraged, Albert bought a sound-on-film recorder and a panel truck to house the equipment.

In the days before audio tape, sound recording was done on 35mm film, and it had to be sent away to a laboratory for development. When the film returned to Ithaca we rented the State Theater to hear our results. One of the first recordings included a loon, which seemed pretty faithful; however, the meadowlark we had recorded was totally distorted. Albert said it sounded like a Bronx cheer. The equipment simply could not handle the higher frequencies contained in many bird songs. So Albert enlisted the aid of Professor True MacLean of the Cornell electrical engineering school and Arthur Stallman, a local consultant. They were able to build a properly designed amplifier that could handle the high frequencies.

But there was still much to do. Besides a good amplifier we needed a sound reflector that would make faraway bird sounds seem louder. It just so happened that during World War I a Cornell physics student, Harley Howe, had made a plaster parabolic sound reflector to evaluate its use in detecting enemy airplanes. Now years later, that reflector was pulled out of storage and used as a model for the lightweight, portable one we needed.

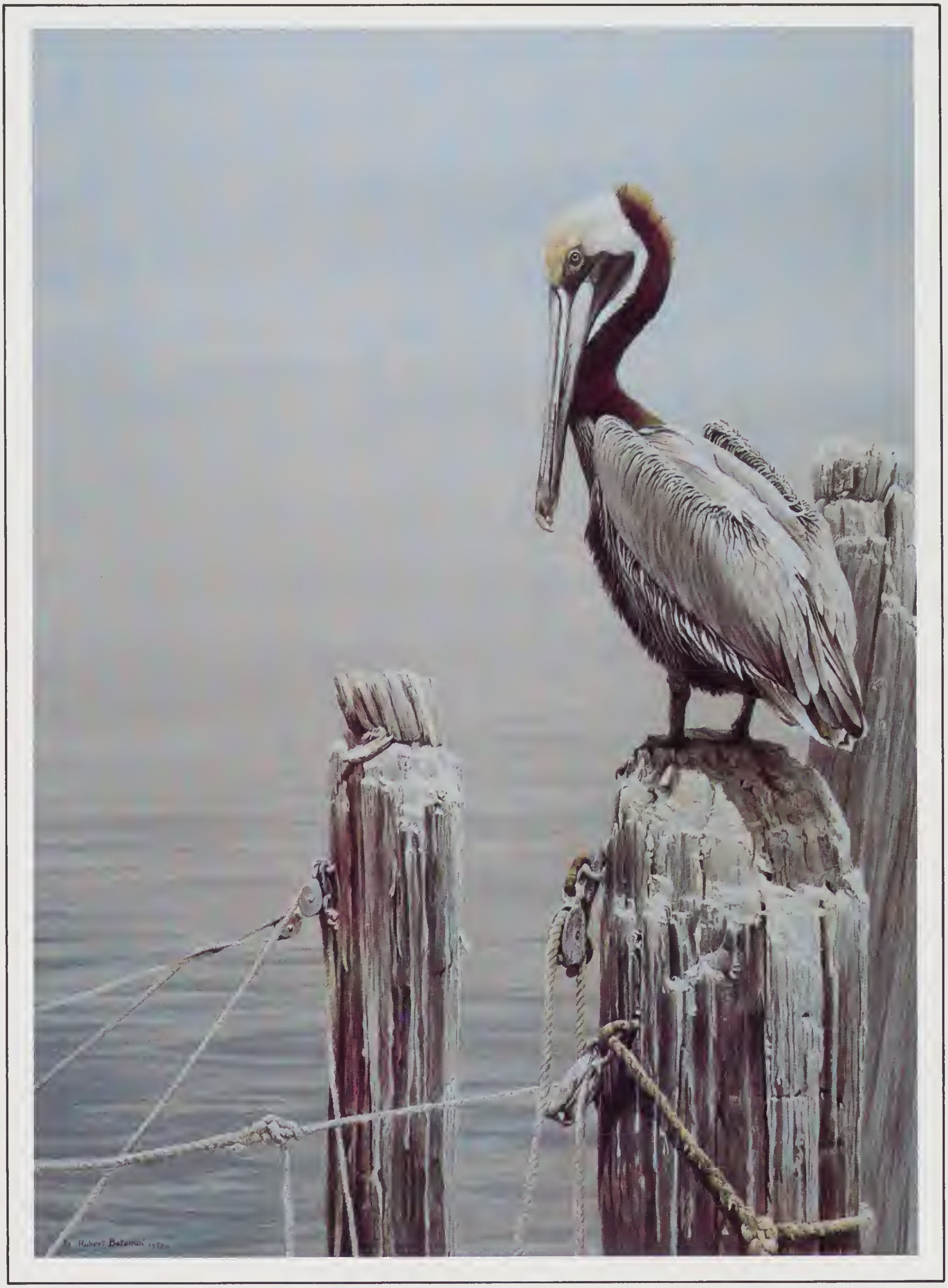
With the help of Paul Kellogg, who had expertise in electronics, we made a copy of Howe's reflector. I contacted some people at the American Museum of Natural History and told them we needed a lightweight, hard substance with which to make our parabola. They gave me a formula that consisted of plaster of Paris, shredded building paper, and a powdered milk by-product. It made a bone-hard substance when it dried. In fact, the museum people said they used it to make bodies of elephants for their exhibits.

The parabola worked surprisingly well. Its operator would point it toward a singing bird while the sound operator in the truck would watch the strength of the incoming signal on a VU meter. Communication between the parabola operator and the recording operator in the truck was two-way. The truck operator, observing the song signal, would advise the parabola operator through earphones when the sound was loudest. The parabola was very directional and when it was right on a bird the signal suddenly became very loud.

Over the next few years, recordings were made with difficulty since singing birds often flew away while the equipment was being set up. Also, noise from farm tractors or even nearby birds would damage the quality of the recording. Nevertheless a small, reasonably good library was acquired and Albert had a disc record cut, "Bird Songs Recorded from Nature," followed by his own book on bird song recording which contained several small discs.

When the far superior technology of audio magnetic tape recording became available after World War II, many species were recorded again, this time with an advantage. Now a recording could be made and immediately played back through a loudspeaker, instead of being sent to a laboratory. The singing bird hearing its own song will often fly close to the loudspeaker to challenge the "intruder." At that moment the tape machine can be switched on and an excellent recording can be made.

The parabola, however, has not been surpassed in its ability to pick up and concentrate bird song, and although today's models are made of aluminum or plastic, the basic instrument is unchanged."



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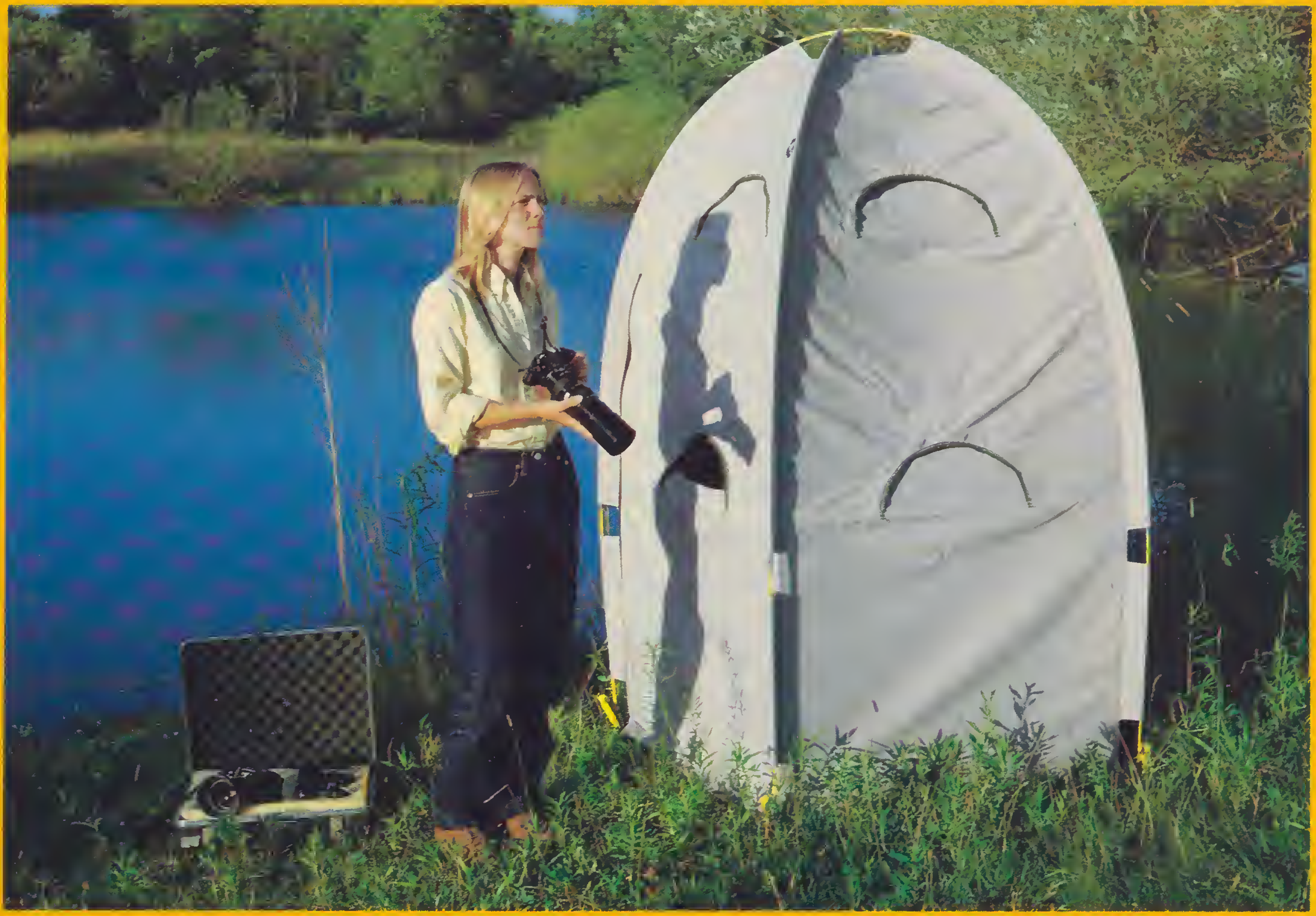

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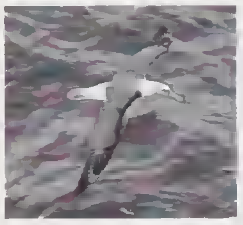
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John Netherton

SECRETS OF THE SWIFT

by **Richard B. Fischer**

AS FLYING BIRDS GO, chimney swifts are certainly different. Not so much in their dizzying flight speeds. Nor in their adaptations for flight. Not even in their plumage or flight feathers. They are different when they come to rest. The flying swifts vanish into some sort of cavity—into a shadowy, secret world as small as a woodpecker hole or as large as a smokestack. They never perch on trees, posts, wires, roof tops or on the ground. Most bird watchers observe chimney swifts only when the birds are flying. Result: the interesting features of chimney swift biology remain a secret to even the most enthusiastic field ornithologists.

What do bird watchers see? A dusky gray, swallow-sized bird capable of flight speeds of over 100 miles per hour, a feat equaled by few other species. At certain angles the swift appears to flap its wings alternately. Indeed, respected ornithologists once insisted that the swift did so even though this notion violated all known laws of avian aerodynamics.

Ornithologists agree that the chimney swift is one of very few birds whose numbers have increased as a result of the arrival of early settlers in North America. Like barn swallows and phoebes, chimney swifts prefer to build their nests on man-made structures. Chimney swifts were already cavity nesters, using woodpecker holes and hollow trees in the vast primeval forests they inhabited. Chimneys offered not only more nest sites, but also new habitats in the form of towns and cities. Chimneys were adopted quickly, possibly as early as the 1600s.

Chimneys are where I have witnessed the swift's unique roosting spec-

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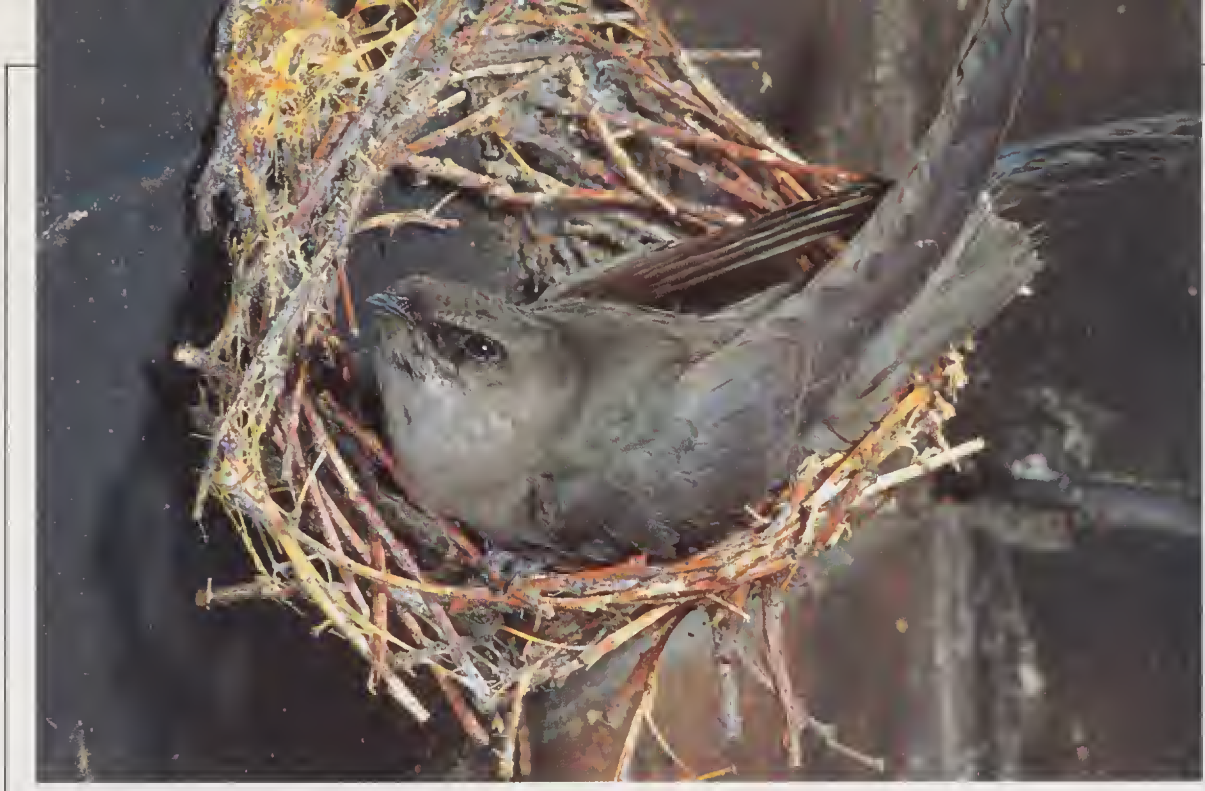


Stephen Maslowski

Chimney swift salivary glue is so strong that nests may be reused for many years.

tacle. This migration phenomenon involves selected ancestral chimneys along the migration routes the swifts use year after year. Before sunset, swifts gather near their chimney; they frequently give their chipper call and do some feeding. When an hour of light remains, the birds assemble into a huge, doughnut-shaped flock. During the next 15 minutes, the flock revolves over the chimney. Suddenly a bird breaks out of the group and drops fluttering into the mouth. Then another. And another. Mob psychology sets in—the entire flock of chipping birds drops precipitately into the roost. They look like smoke going back into the chimney. T. Gilbert Pearson, long-time president of the National Audubon Society, saw 1,000 birds stream into a North Carolina chimney in less than 20 minutes. That is not a record number, however. Ornithologist Gordon L. Hight once took almost 7,000 swifts out of a chimney in Atlanta, Georgia.

We call it the chimney swift but the bird also nests in other structures such as barns, silos, woodsheds, abandoned houses, air shafts, even wells. And when it does the structures are ideal for prying into the chimney swifts' secret life—as I learned one day in 1936 when friends showed me some fledgling swifts in an unused Catskill Mountain silo at Beaver Kill, New York. They were the first chimney swifts I had seen that were not flying, and I examined them minutely. They impressed me so profoundly that I became a student of this common yet unobtrusive and little-known bird even though I was only a high school student at the time.

It was my good fortune to spend the next 17 summers in the Sullivan County, New York hamlet. By 1939, when I had become a licensed bird bander and had perfected a method of capturing chimney swifts after dark using a headlight and insect net, I was deep into field research. The farmers gave me ready access to the barns, silos, woodsheds, and chimneys that swifts occupied. These structures offered unparalleled research opportunities and I exploited them vigorously.

Devising techniques to study swifts was almost as fascinating as the data I accumulated. By erecting photographic blinds in the buildings, I was sometimes within six feet of the nesting birds. And by eating my lunch in a blind, I could observe the birds for long, uninterrupted periods. To obtain pictures of nest life, I mounted my camera equipment to the roof timbers, and tripped the shutter from my hiding place by remote control.

In this soot-colored species the sexes are carbon copies. Plumage is identical, even to the brood patches. Each weighs slightly less than one ounce. How to tell the swifts apart short of dissection remains a mystery. But I had to know; therefore, I sacrificed an individual which turned out to be a female. Knowing her sex enabled me to figure out that her mate was a male and, in turn, that his new mate was a female. I kept track of the two by banding them and dabbing paint on various parts of their bodies, especially the wings. That worked fine; the birds were identifiable hundreds of feet away through binoculars.

Behavioral cues are important to male birds in determining the sex of others of their species. If a possible mate gives the wrong response, the male assumes it is another male and looks elsewhere. What response does a male chimney swift expect from a female? We do not know for sure. Perhaps, at the beginning of courtship, you have seen three swifts flying about your garden and chipping loudly. Two birds seem to be chasing the lead bird, doubtless a female, as they execute sudden angular turns in unison. Later in the pair-forming period perhaps you saw two birds, one pursuing the other as they glide with their wings forming a V. The pursuing bird raises its wings in the V position first and then the lead bird does the same. We think this is how chimney swifts establish a pair bond. V-ing, as I dubbed it, continues even after the eggs hatch, for it reinforces the pair bond.

Chimney swifts are intimately acquainted with the limited number of possible nest sites because they use them for roosts before pair formation begins. Unlike garden songbirds in which nest-site selection follows pair formation, paired chimney swifts know in advance where their nest will be built. They do not have the wide choice of nest sites open to songbirds.

This limited number of sites greatly facilitated my research, for chimney swifts exhibit an unusually strong tendency to return to their previous nest sites, where they are easily captured, banded, and color marked. Seventy percent of my birds came back to their former nest sites. Such nest-site fidelity is higher than that for most of our common land birds. For example, studies show that an average of 53 percent of eastern bluebirds and 40 percent of tree swallows return to their former nest sites.

Nest-building house wrens pick up twigs from the ground near their nests. So do catbirds, thrashers and many other songbirds. But not chimney swifts. They go long distances to find a tree branch bearing dead twigs. To obtain a twig, a swift flies at it and snaps the twig off with its feet. If the bird misses, it circles the tree and usually strikes the same twig again. And again. Until it is successful. Some persons maintain that the swift occasionally breaks a twig off with its bill. Given the bird's small, soft bill that seems unlikely. However, between the dead branch and the nest, the bird does transfer the twig to its bill.

Chimney swifts build their nests near the spot on the wall where they had roosted during the pair-formation period. Arriving at the nest, a bird attaches its twig to the other twigs, then adds saliva produced in its oversized salivary glands. In time the twigs take shape as a nest large enough for the bird to sit on.

Although both sexes build, they each take turns and do not build simultaneously. Their salivary glue is so strong that nests built where rain cannot soften the glue may be reused for several years. The greatest strain on a chimney swift nest is where the upper, rear portions meet the surface to which the nest is fastened. This is precisely the area the swifts strengthen with an extra semicircle of saliva. They add this reinforcement while sitting on their eggs.

Darkest of the mysteries surrounding chimney swift breeding biology was where the birds copulate. In the United States the white-throated swift and in Europe the common and white-rumped swifts copulate on the wing and certain ornithologists claimed that this method was used by chimney swifts also. The answer came unexpectedly as I observed a pair of birds in 1951. While watching nest building one afternoon, I wondered why both birds lingered so long before going out for more twigs. Hearing one bird give a series of undulating chippers, I assumed it was about to depart. Instead, it fluttered up onto the back of the other bird and mated with her. Then the male returned to the half-finished nest and stayed for several minutes. Next he fluttered down beside his mate, where they preened themselves but not each other as many songbirds do after copulation. This mating ritual—I saw it four times—was so stereotyped that the notion that swifts mated on the wing became untenable. Their first egg was laid the following day with the nest only half finished. How swifts finish a nest before their eggs hatch was another mystery. I discovered that each time a bird enters the nest to incubate, it adds a new twig. So, twig by twig, their jackstraw nest takes shape. It is complete when the eggs hatch.

How many minutes one bird will sit on the eggs was another chimney swift secret I wanted to reveal. Hidden in

Richard B. Fischer

Chimney swifts nest where the light is dim.

blinds for long observation periods, I discovered it was not unusual for an incubating swift to sit for nearly two hours. The shortest period was 34 minutes (by a male) while the longest was 216 minutes (by a female). Their commitment to keeping the eggs warm in a nest with no lining is so strong that a sitting bird usually departs only when relieved by its mate.

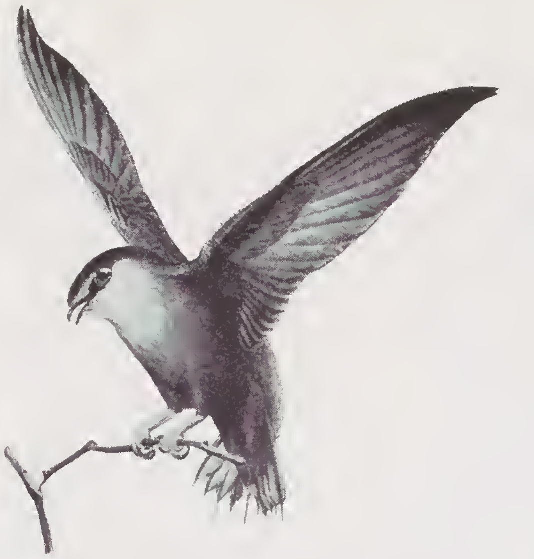
Another fascinating phase of chimney swift biology begins when the young hatch. Homely but durable, their legs and toenails are unusually well developed. Around 1920, ornithologist Frederick H. Kennard told of a chimney nest containing two eggs that fell down into the ashes of the fireplace. One of the eggs evidently hatched; he found the tiny swiftlet clinging to the fireplace screen. Though naked, blind, and injured, the little waif had crawled out of the ashes, across the hearth and up the screen. It lived!

Long shrouded in mystery is the unusual circumstance of more than two adult chimney swifts caring for a nest containing young. Two birders, Mary Day in 1899 and Althea Sherman in 1921, recorded this phenomenon. Professor Ralph Dexter of Kent State University chronicled it over a period of 40 years. Why should an adult bird capable of reproduction prefer to associate with a mated pair and help with their young?

Helpers begin as visitors to the site after a pair has begun the nest, after the eggs are laid, or after the young have hatched. As a visitor, the odd bird does not usually roost with the pair in characteristic chimney swift roosting position, side by side. Instead, the visitor will be off to one side. At some point after hatching, the visitor becomes a helper, sharing in feeding and occasionally brooding the young.

Most extra-parental situations involve one visitor; Dexter found 80 such cases. But he noted two helpers in 13 percent of his situations, and three in rare instances. And, Dexter reports, male helpers outnumber females three to one.

Who are these extra birds? They are probably immature birds capable of breeding but not yet ready to nest. However, the issue is clouded by Dexter's discovery of a female that bred successfully for four years, then became a helper herself.



Are the visitors really helpers? One would assume so, for they share in satisfying the nestlings' food requirements. Curiously, Dexter has shown that the number of young produced by any given pair of swifts is not increased when helpers are present.

Do the helpers themselves benefit? Here one is tempted to apply biologist Glen Woolfenden's ideas concerning cooperative breeding, where helpers may "inherit" a part of their parents' territory. But there is a problem: the chimney swifts Dexter and I have studied had not filled their available habitat as had Woolfenden's scrub jays. There was no need for the swifts to wait for a place of their own. No, that theory does not fit the facts. And the swifts are not telling.

In the late 1930s southern swift banders began tagging thousands of southbound swifts. Gordon Hight was one of a group of banders who in a single year captured and banded 71,000 birds. Each spring they recaptured some of them on the northward flight. But where had they been all winter?

That secret, which had nagged at ornithologists for generations, remained unanswered until 1944. How it was revealed conjures up visions of steaming tropical jungles, primitive people, and the vast headwaters of the Amazon in South America. For it was in that remote wild land that some native hunters killed a flock of swifts roosting in a hollow tree. Thirteen of the birds wore U.S. Fish and Wildlife Service bands. Thinking them valuable, the Indians gave them to a trader who forwarded the bands to the American embassy in Lima. From there the bands went to the bird banding records office in Laurel, Maryland. Those 13 birds had been banded in several eastern United States cities plus Kingston, Ontario. Ten years later a chimney swift, banded in Memphis, Tennessee two months earlier, was collected at Trujillo, Peru. At about the same time, one or two unbanded specimens were taken in Lima. Evidently the Amazon headwaters represent an extensive wintering area for North American chimney swifts. Precisely how extensive? We do not know. Nor do we know fully how an unobtrusive little "chimney swallow" finds its way from the Peruvian jungles to the same barn in New York State where it hatched less than a year before.

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THE AUTHOR

Richard B. Fischer is professor of environmental education at Cornell University.

Our thanks to Ralph W. Dexter for his careful reading of the manuscript.

Since high school Richard Fischer (second from left) has been a chimney swift enthusiast.

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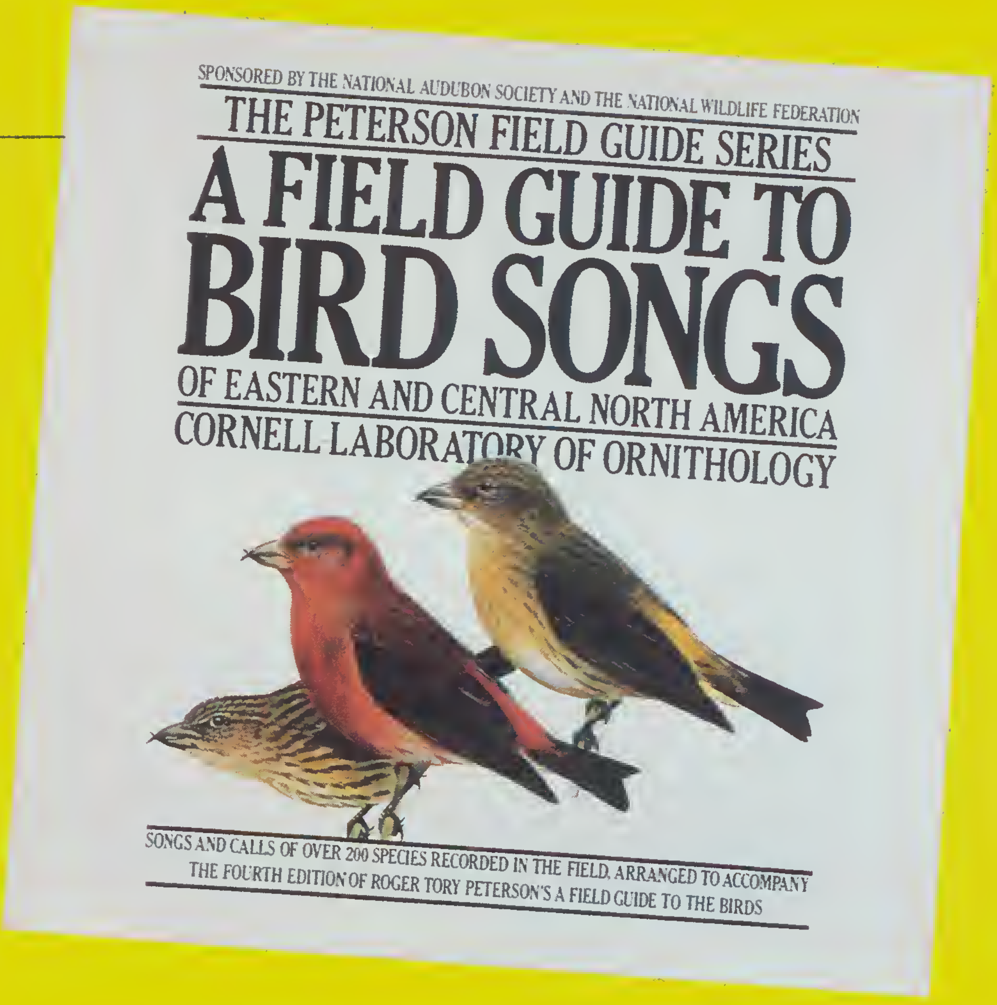
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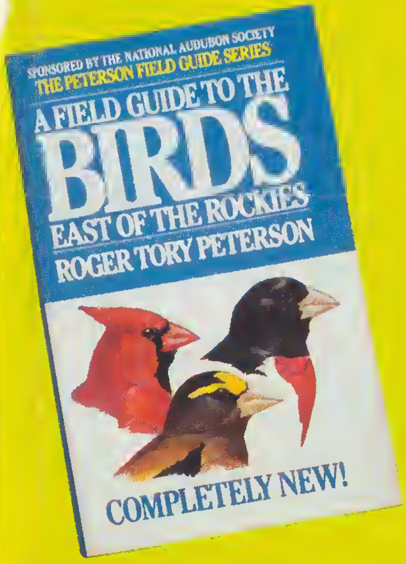
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CHIPS FROM THE NIGHT SKY

Frans Lanting

by **Kenneth P. Able**

IT IS A STILL, WARM NIGHT in late May, muggy with low clouds and a light drizzle. In the distance I hear gray treefrogs, intense in their mating activities in this ideal weather for amphibians. My attention, however, is fixed on other, less obtrusive, sounds. Silent to the uninitiated but magnetic to my ears are the calls of night-migrating birds. From the myriad calls I sort out the reedy "feeer" of the gray-cheeked thrush headed for some northern fir forest, and the clearer whistle of the more common Swainson's thrush. Most notes are unidentifiable "chips" and "seeps" from warblers and other late spring migrants. I wonder why one hears so many calls on nights like this one. Are the birds having trouble finding their way in the mist and calling to one another in confusion? Perhaps they are trying to maintain loose groups with others of their kind. Maybe they always call, but are simply lower in these poor flying conditions, making them easier to hear.

How many individual birds are up there? Under clear skies I could turn on the light of a portable ceilometer and with the aid of a telescope I could see the birds passing through its beam, count them and determine their direction. On a cloudy night I could use radar. Because of the drizzle neither of these techniques will work—when beams of light and microwave energy are reflected by water droplets, the birds become lost in the "noise." So I am left to wonder what they may be doing.

Curiosity about the seasonal migrations of birds is not new. Humans surely marveled at the appearance, disappearance and passage of birds long before recording thoughts in pictorial form. The earliest natural history writers described the phenomenon and attempted to explain what they observed. Modern students of animal behavior have learned much about migration. Many of the ground rules have been laid, but we are still faced with a profound and unanswered question. By marking birds with uniquely numbered aluminum bands we have learned that many individual migratory birds return year after year to the same localities where they nested or spent the winter in previous years. Yet we cannot explain how they navigate with such precision over distances of many thousands of miles. The question is one of the most alluring in animal behavior.

Why do birds engage in long-distance migration? In general terms, it is a means of escape. Many parts of the earth are habitable for only portions of the year. It is easy to exploit those environments during the flush seasons, but they must also be endured during periods of climatic hostility. Many life forms—invertebrates, reptiles, amphibians, and mammals—cope by entering an inanimate state (diapause, estivation, or hibernation).

Birds, with their ability to fly, have solved the problem by evacuating an area when they cannot survive in it. The conditions for the evolution of migration are easy to conceive: if a bird can produce a larger number of offspring by breeding in one area and moving to another for the rest of the year than by remaining in one place, and if migratory behavior is genetically controlled, then natural selection will favor the migrant over the non-migrant.

This does not answer the more specific and complicated question of why species A migrates while species B does not. Because the environments on earth are constantly changing, migration is a continuously evolving system, not something that sprang into existence at one time in the dim past. Indeed, since no two species or individuals are alike, there may be nearly as many scenarios for the evolution of migration as there are birds.

Let us return to the more accessible question of how birds find their way during their epic journeys. In formulating hypotheses, we are not flailing entirely in the dark. Several decades of research have established numerous facts that have set boundaries on our theorizing. Although some species migrate by day (swifts, swallows, many finches, hawks, and cranes), the majority of birds migrate at night. Whatever means they use to find their way must work in darkness. Some birds, especially large water birds, migrate in flocks or in family groups where the inexperienced might rely on and learn from the older birds, but most birds journey alone. Autumn banding studies have shown that in several species the young migrate much later than the adults; also, the two sexes often migrate at different times. In these cases the explanation for their behavior is not shared knowledge or following the leader.

Yet most migratory birds have remarkable homing ability. To be able to return to specific places, birds have to learn something about the sites. A bird learns its natal area during the first summer of life; transplanting a youngster will result in attachment to the new site. On its first autumn migration the young bird apparently has no specific goal, as shown in studies of starlings by Dutch ornithologist A. C. Perdeck. Rather, it flies in a given direction for a distance that may be genetically programmed. With luck, this will bring the bird within its species' wintering range. Later in the season it will fix on a specific site to which it will probably return in subsequent years. What birds experience or learn that enables them to find places with precision is unknown but basic to the homing process.

Homing ability has been demonstrated in many kinds of animals from limpets and ants to salmon and salamanders. What sets birds apart is that in many cases the distances involved are so great. That fact precludes the possibility that birds directly sense the goal or "home" by sight or smell alone.

Assuming birds have no extraordinary capacity to sense their goal, we are left with two possibilities: location-based navigation and route-based navigation. The former involves variations on the "map and compass" scheme conceived by German scientist Gustav Kramer over three decades ago. Birds are able to determine compass directions from several different environmental cues—this is called orientation. However, the map component

Jeff Lepore

BHL

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Wayne Lankinen

requires something more: a sense of one's location relative to the goal. Only when the map is resolved can the bird effectively use its compass.

Route-based navigation assumes that animals process information during migration which allows them to find their way back. For migratory birds we know almost nothing concerning the map or navigational component of their behavior, but a fair amount has been learned about the compass problem.

When I first began to study migration in the late 1960s, we knew that migratory birds had several orientation capabilities. The pioneering work of Gustav Kramer had shown that some birds use the sun to determine compass directions. Another pioneer, Franz Sauer, showed that night migrants could make similar determinations using stars, even the star patterns in a planetarium. Sauer's early studies were refined and extended by Stephen Emlen of Cornell University. Working both outdoors and in a planetarium he showed that the indigo bunting can use stars as a compass, that the star patterns themselves are used, and that major components of the star compass are learned during the first summer of a young migrant's life. At the same time, Frederich Merkel, Wolfgang Wiltschko, and their colleagues at Goethe University, Frankfurt, West Germany, were reporting on experiments which suggested that European robins had a magnetic sense of direction. Subsequent studies on migrants and homing pigeons have built a convincing case for the existence of a magnetic compass in birds.

With these capabilities in mind, my aim was to look at the orientation of free-flying migrants to see if their behavior was consistent with the results of the controlled laboratory studies. I began in Louisiana and Georgia in collaboration with Sidney Gauthreaux at Clemson University. We watched migrants as they passed through the beams of a portable ceilometer and simultaneously monitored the flow of migration on a broad scale with weather surveillance radar. What we found was not at all what we had expected. The songbird migrants—warblers, vireos, thrushes—we observed at night almost always flew in the direction the wind was blowing, even when that meant flying in directions opposite those expected for the season and even when the birds' flight speed exceeded the speed of the wind. Thus the birds were not being blown passively in peculiar directions. And if the wind direction changed during the night, the birds reoriented themselves so that they would be heading downwind.

This picture of songbird migration bore faint resemblance to that emerging from experiments on caged migrants. The wild birds used wind direction as their primary orientation cue even on nights when the stars were visible and the earth's magnetic field was undisturbed. One message from this is that we should not generalize from experiments performed under narrowly defined conditions. As I was to discover, one also must be wary of extending field results to other birds and regions.

On weather radar, echoes from songbirds were easily distinguishable from those of flocked migrants such as waterfowl and shorebirds. These larger, faster migrants were more selective of the weather conditions in which they migrated, and rarely flew in large numbers except when the wind was blowing in the direction they were heading anyway. This indicated to us that when free flying, different types of birds respond to directional cues in different ways.

When I moved my studies to upstate New York I expected the nocturnal migrant songbirds to behave as they had in the southeastern United States. I soon discovered this was not the case. On nights when winds blew in unfavorable directions for migrants, there was seldom any correspondence between the birds' orientation and wind direction. Even though the songbird species in eastern New York were similar to those in the Gulf states, they responded differently to directional information, a hitherto unexpected complication.

Some nights most migrants did fly in peculiar directions. These instances were tantalizing because they seemed to happen under solid overcast skies. However not all cloudy nights with unfavorable winds had such flights. By tracking birds with radar over several seasons under closely monitored weather conditions, a pattern emerged. When skies became solid overcast so that birds could see neither sun nor stars, and winds were opposed to the normal direction of migration, the birds headed downwind and thus in inappropriate directions. On days when the birds could see either the sun or the stars they oriented normally, regardless of the wind. These observations suggest that migrants respond to directional cues in a hierarchical manner; in this case the visual cues—sun and stars—took precedence over wind direction.

Unfortunately, we cannot identify species with radar and ceilometer techniques. A swarm of migrants may contain 75 species and individuals of varying age, experience, motivation, and migratory goal. To overcome this problem, I borrowed a technique from Stephen Emlen and Natalie Demong which allowed me to track single birds. They devised a method for launching nocturnal migrants from small boxes carried aloft under helium-filled balloons. At a predetermined height above the ground the bottom of the box drops open and the bird flies out.

Using this method, I tracked white-throated sparrows and found that most flew on straight and reasonably level paths. My releases were made under precise conditions: clear, starry nights when winds were light, but opposed to the normal direction of migration. Under these conditions, I predicted that sparrows would use the stars and orient in the appropriate direction, regardless of the wind, and that is what they did.

I also released sparrows fitted with frosted lenses so that they could not see the stars. These birds embarked on straight and level flight generally in downwind, inappropriate directions. Thus the birds wearing frosted lenses behaved like migrants in nature deprived of visual cues. What is even more remarkable, as any pilot can attest, is that they were able to determine wind direction without a visual frame of reference.

We have learned a great deal about how migratory birds find their way from wintering to breeding areas and back again. New knowledge about the information birds "sense" to determine compass directions has come especially rapidly. But as I listen to their "chips" from the night sky I am aware that we cannot explain how they do what we know they do. No bird has ever been followed over the course of an entire migratory journey. Do they move straight to their destination or wander about, homing only when they near the goal? Our inability to answer these questions generates the mystery of migration; the possibility of discovering answers makes it an enthralling subject for study.

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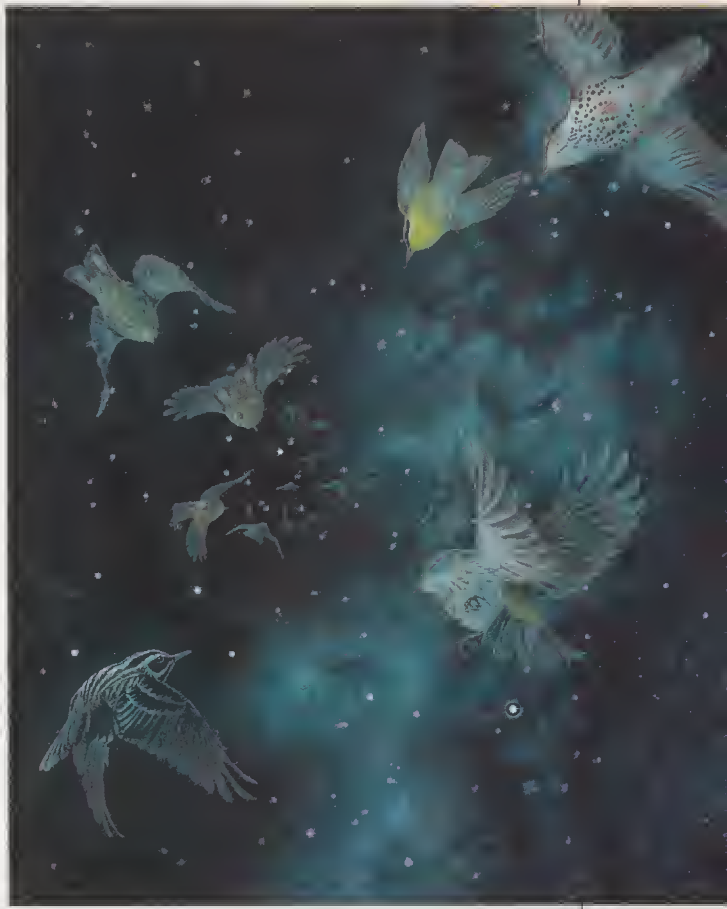

Collection of Robert Blackman

On weather radar, echoes from flocked migrants, such as Canada geese (left) and dunlins (below), are distinguishable from songbirds. (Above) Guy Tudor's dramatic painting of night-migrating songbirds.

Tim Fitzharris

F.S. Todd

SEABIRDING

by Ron Naveen

Jeanne White (Photo Researchers, Inc.)

Left, black-browed albatross. Above, blue-footed boobies.

WE ROUNDED THE HORN at 2 a.m. and turned into the 600 mile long, windswept expanse that separates terrestrial humanity from the white desert to the south. I awakened early, went directly to the ship's fantail, and began my sea watch in the murky morning light of the world's bottom. We seabirders are used to inexorable scans of the horizon, straining to see any seabird that might whiz by or join the stern's trailing flock. Many uneventful hours may pass, and one's patience and discipline may be stretched to the limit. A seabird may emerge unexpectedly and then disappear just as quickly. However, in this circular latitudinal belt of unimpeded wind and sea known as The Roaring '40s and The Furious '50s, frustrations are reduced and satisfaction is more frequent than in other waters.

There were numerous southern giant petrels in this morning's wake and scattered numbers of Wilson's storm-petrels and black-browed albatrosses. The "g-ps" and "brows" had been with us constantly through the Beagle Channel and into the Drake Passage; the diminutive storm-petrels were new additions and would increase in number as we got closer to their breeding grounds on the Antarctic Peninsula. They were also familiar sights, common post-breeding visitors to my regular pelagic haunts in the western north Atlantic Ocean. Wilson's storm-petrels are about six inches in body length and seemingly vulnerable to being swept away by the next gust or to drowning in the next swell. Sailors call them Mother Carey's chickens and, depending on the tale, they are considered omens of either good or bad luck. One myth has Mother Carey turning the souls of drowning sailors into storm-petrels, hence the fear

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that storm-petrels precede the worst of fates. I'd rather believe the contrary superstition, that their presence indicates the protection of both birds and mariners from imminent danger.

Today I was preoccupied by the prospect of seeing my first wandering albatross. If you haven't guessed by now, we seabirders are unrelieved dreamers. Dreaming compensates for the obstacles we face. Terrestrial birds give us relatively long looks; we can take time to look for field marks that clinch an identification. Seabirds, however, are constantly on the move and only rarely offer a second chance to guess their identity. Adding them to one's life list requires numerous trips offshore in myriad kinds of craft, from fishing headboats to tramp steamers, and in all sorts of weather, never knowing what might be served up. There is motion everywhere—the birds, the boat, the sea, and one's stomach.

Consequently, seabirding generates either antipathy or unrestrained enthusiasm, and few reactions in between. Too often the high hopes that accompany the start of a pelagic trip are lost in the disappointment of missing the desired birds and having spent so much time, effort, and comfort in the process. The cost is high but those willing to pay are rewarded. The wandering albatross, with a wingspan approaching 11 feet at maturity, is the crème de la crème of seabirds. Every seabirder with mettle craves this bird; the myths surrounding it and the reality of its unparalleled grace make it a capstone that justifies the long hours and strenuous effort seabirding often requires.

And finally this January morning it came, soaring past a swarm of slightly smaller giant petrels, banking and arcing through our ship's trailing drafts. It hovered no more than 15 feet away. The appearance lasted 30 minutes, interrupted once by the wanderer's brief descent to inspect a potential food item on the surface.

The wanderer of the southern ocean sky is a fascinating creature. After a fledgling period of almost 280 days, the longest of any bird, the young wanderer roams the '40s and '50s for eight or nine years before it makes its first attempt to breed. Because of the lengthy fledgling period, mates breed every two years and one season's fledglings are still present when the next season's adults return to the breeding grounds.

My first wanderer was approximately six years old and still had some black on its tail and mantle. It was joined by a three-year-old bird which had much dark brown on its head and body. As I watched them I wondered how many times they had traveled past this spot. How many circumnavigations had they made in their brief lives? Finally for no apparent reason, they soared away.

Seabirding in the Arctic, on island outposts in the middle of the ocean, or in Antarctica begins with identification. To be successful seabirders we must restructure the usual emphasis on field marks. Fast-moving seabirds may yield no more than a fleeting glimpse. The trick is to use this time advantageously by examining seabird flight patterns and behavior, valuable identification clues. Feeding styles and relative size also may be important.

Recognizing behavioral subtleties requires some practice, but can be learned easily. They force birders to ascertain a seabird's *gestalt* or what the British call "jizz." Both relate to the combined visual and abstract impressions a seabird conveys. Is it powerful? Does it proceed with quick movements? Is it piratical? Does it soar or glide and to what extent? This evidence places the seabird into its proper generic niche, setting the stage for using field marks more readily and accurately. Field marks are useless if the albatross you think you saw is actually a giant petrel. I've seen black-capped petrels identified as greater shearwaters because the jizz was incorrectly assessed.

Reliance on subjective characteristics began because birders found it difficult to focus their binoculars while the subject was constantly shifting. Only one modern field guide, *Seabirds* by Peter Harrison, reflects the evolution of seabirding skills. Perhaps our fascination with seabirds began with Samuel Taylor Coleridge's "Rime of the Ancient Mariner" but it wasn't until 1928 that someone attempted a seabird field guide. H. B. Alexander's *Birds of the Ocean* was a bold stroke, considering the lack of accurate, or in some cases, any information about these birds. Close on its heels was Robert Cushman Murphy's epic *Oceanic Birds of South America,* published in 1936. Murphy's two-volume treatise of South American seabirds remains a classic, in-depth treatment of seabird breeding biology, natural history, and identification. Although these two works kept some interest in seabirds alive, progress in identifying seabirds was scant for the next 30 years. A second edition of Alexander appeared in 1954, but little new information was presented, with many gaps in knowledge still remaining.

In the 1950s and '60s, James Fisher and Ronald Lockley published their natural history study of north Atlantic pelagics, *Sea-Birds,* and each had written detailed natural history treatises (Fisher's *The Fulmar* and Lockley's *Shearwaters*), but these did not compare in comprehensiveness regarding field identification to Roger Tory Peterson's United States and European field guides. Some progress was made with the Smithsonian Institution's *Prelimi-*

F. S. Todd

Northern fulmars closely resemble gulls in size and shape but have a bullheaded jizz.

Wm. Curtsinger (Photo Researchers, Inc.)

Northern gannets are attracted to chum and fly with deep wingbeats interspersed with glides.

nary Seabird Identification Manuals in the 1960s where, for the first time, species accounts noted seabird behavior and made comparisons among similar species.

The 1970s saw the phenomenal growth of pelagic bird watching in the United States and elsewhere, and it became apparent to pelagic pioneers that further identification tools were needed. A committed group began to examine critically the behavioral aspects of seabird identification. How could flight and feeding characteristics clinch an identification of a difficult seabird? Did certain seabirds prefer warmer waters? Were some attracted to vessels while others avoided them? Leading birding journals began to publish identification articles using these techniques, as did one field guide, Harper & Kinsky's *Southern Albatrosses and Petrels.* But it wasn't until this year with the publication of Harrison's book that a guide fully incorporated an analysis of behavioral criteria as a means of identification.

Seabirds are consummate flappers and gliders and their flight aspects are the key to correct identification. (Penguins have taken these skills underwater.) Indeed, each family of seabirds flies differently and with practice these flight styles, as well as feeding behavior and relative size, can become part of a birder's identification arsenal.

Regarding flight behavior, concentrate on the seabird's course, speed, effort, wing position, and jizz. Is its flight path straight, zigzag, or erratic? Does it rise or fall along its course? Does it fly quickly, moderately, or slowly? Does it fly with few or many wingbeats, and how much gliding and banking does it incorporate into its flight pattern? When flapping, does it take its wings above its back (and to what extent), or just to the horizontal plane? Does it soar high above the water? Does it remind you of a swallow, a bat, a nighthawk, or a shorebird?

If you see the bird feeding, note its style. Is it a plunge diver, surface picker, or foot patterer? Does it harass other seabirds? Is it attracted to ships or chum thrown overboard? Does it associate with others of its species or mingle in mixed groups of seabirds?

Gulls and terns are so well known that they make useful introductions to the new approach. Gulls fly with relatively deep wingbeats, taking their broadly based and rounded wings well above their backs, fluttering often to the water's surface to feed. There is considerable flapping in their flight repertoire, and only a minor amount of soaring. Among the gulls, black-backed gulls have looser, slower wingbeats and appear heavier (they have a heavier jizz) than glaucous gulls which in turn have a slightly heavier jizz than herring gulls. Herring gulls fly more slowly than the lighter jizzed ring-billed gull, and ring-billed gulls fly more slowly than Bonaparte's gull and kittiwakes. Bonie's and kittiwakes are the most aerobatic of the gulls, with quick wingbeats that resemble those of terns.

Terns do considerable flapping, but with stiffer wingbeats than gulls, and take their wings through a narrower arc. Their wings are more narrow and pointed than gulls' and terns plunge dive after subsurface prey. Some of their plunge diving is preceded by hovering. Caspian terns and gull-billed terns have slower wingbeats than royal terns, and all of these have much slower wingbeats than Arctic, roseate, and Forster's terns. The least tern has the fastest wingbeat in the group.

Northern fulmars closely resemble gulls in size and shape, but have a bull-headed jizz. They appear neckless and give a powerful impression. Their very stiff and shallow wingbeats are interspersed with gliding and banking on outstretched, stiff wings. Compared to gulls, they proceed more quickly and use fewer flaps. They are curious, rapidly approaching ships, then departing after their brief inspection. They fly close to the water, sometimes soaring, with their powerful movement the most noticeable flight characteristic. Jizz is crucial because northern fulmars have two color phases. Light-phased fulmars can easily be mistaken for lightly colored gulls and dark-phased fulmars closely resemble dark shearwaters. Confusion may be avoided if the birder knows the jizz of each group.

The northern fulmar's closest relative is the southern or Antarctic fulmar. It has only one color phase, but shares the northern fulmar's bull-necked jizz and quick powerful flight. Other relatives in the southern oceans are: huge giant petrels, which do more flapping, with deep, slow wingbeats, and are much larger and more prone to gliding and soaring high above the surface; and, the beautiful Cape pigeon (also called pintado petrel).

Skuas and jaegers are the raptors of the seabird world, and they harass and chase other seabirds. All show a flash of white in their primaries. Skuas have broadly based wings and closely resemble gulls in bulk and size, but they have a steadier, more powerful flight and an aggressive jizz. Skuas are very curious about large concentrations of birds, and may rest on the surface among potential victims.

To find great skuas on our winter pelagic trips in the western north Atlantic, we put down a chum slick of ground beef fat and stale bread, which attracts a trailing flock of northern gannets, black-legged kittiwakes, northern fulmars, and great black-backed and herring gulls. Then we wait for the skua to come barrelling through the feeding throng. On our summer trips, sometimes we find South Polar skuas mingling with thousands of northward migrating greater, Cory's, Manx, and sooty shearwaters.

Jaegers have a more slender and less bulky jizz and frequently can be recognized by their twists, turns, and changes of direction as they pursue prey. Pomarine jaeger is the largest, has the broadest based wings, and appears relatively large headed and large billed; it proceeds with very steady wingbeats. Parasitic jaeger is smaller with a more lilting flight during which it may rise and fall with each wingbeat. Long-tailed jaeger is smaller and more slender than the parasitic, with an even more buoyant flight. Based solely on field marks, adult jaegers may be identified by the shape of their elongated central tail feathers. However, the birds range in color from light to dark and the diagnostic tail feathers may be broken in adults or absent in immature birds. So the subtleties of flight and jizz become very important and may be the only clue to these birds' identity.

E. R. Degginger (Bruce Coleman Inc.)

Red-billed tropicbirds are white plunge divers with very long tail streamers.

Shearwaters fly close to the surface, with bursts of wingbeats followed by periods of gliding and banking. Sometimes they soar, but generally not to considerable heights. Shearwaters have longer and narrower wings than gulls, skuas, and jaegers, and feed by making short dives from the surface. The repetitive flap-and-glide pattern is characteristic and may be discerned at great distances. Many species of shearwaters can be identified by the quickness of their flaps and the length of their glides. Cory's and greater shearwaters rival a ring-billed gull in body length; Cory's has very slow and floppy wingbeats, while greater has stiffer and stronger wingbeats. The smaller black-and-white Manx, Audubon's, and little shearwaters are comparable to a Bonaparte's gull in body length; Audubon's shearwater flaps more often and glides less than Manx shearwater, while little shearwater has the fastest wingbeats of the three.

The many kinds of gadfly petrels resemble shearwaters, but inject much dynamic soaring into their flight repertoire. They proceed skyward on the strength of a few flaps, then swoop downward in a powerful glide close to the water's surface. Gadfly petrels soar much more than shearwaters, and rise and fall along their flight path.

Another group of flappers and soarers are the sulids, the gannets and boobies. They are very bulky, as large as loons, and their bodies are tapered fore and aft. This bulky, double-pointed jizz in flight is easily recognizable. They are much larger than shearwaters, gadfly petrels, jaegers, and skuas. Sulids are unparalleled plunge divers. Northern gannets dive from heights of 100 feet, and blue-footed boobies can dive into water no more than a foot deep without breaking their necks. They often soar high above the water searching for subsurface prey. Northern gannets are attracted to chum and red-footed boobies to ships, and all fly with deep and steady wingbeats, interspersed with glides.

The two seabird families which soar the most and flap the least are the frigatebirds and the albatrosses, and there should be little difficulty learning their jizz. The frigates have long, narrow, and pointed wings and the greatest wingspan-to-weight ratio of any bird. They can soar to considerable heights. They assemble in swirling masses high above their breeding and roosting sites, circling like kettles of migrating hawks. Frigatebirds feed by swooping to catch flying fish breaking the surface and by harassing boobies and tropicbirds, forcing them to disgorge recently caught food. Albatrosses are considerably more bulky than frigates, with a humpbacked appearance, broad and often bent wings, and a flight plan dominated by soaring and gliding.

On the other end of the spectrum are the flappers: storm-petrels, diving-petrels, prions, alcids, and tropicbirds. Diving-petrels and alcids are small and chunky, with a weak, whirring flight close to the surface. Blue-gray prions fly quickly and erratically over the water, with considerable twisting and turning. Tropicbirds are white plunge divers with very long tail streamers.

Storm-petrels deserve special mention because their flight and feeding characteristics can be used to identify individual genera and species. For example, Wilson's and Elliot's storm-petrels do much flapping on their short, rounded wings, with little gliding, and they proceed on a relatively direct flight path. In flight they resemble swallows and have a distinctive habit of pattering their feet on the water as they search for food. Also, they are gregarious and attracted to ships and chum.

Leach's storm-petrel has more pointed and longer wings, slower, deeper and less frequent wingbeats and flies with erratic changes of direction. In flight it resembles the nighthawk. White-faced storm-petrel hops over the surface like a miniature kangaroo. The white-throated storm-petrel hits the surface with its large, spatulate feet, then instantly changes direction.

While unlocking these identification secrets we seabirders have an opportunity to examine the adaptations of seabirds and add to our knowledge of their natural history. One adaptation is the ability of their special nasal glands to expel excess salt ingested with sea water. Look closely at seabirds and you'll see the salt solution continuously dripping from their bill tips.

Another adaptation is their migrations. Arctic terns leave wintering grounds in the high latitudes of the Antarctic to breed in the high latitudes north of the equator. Wilson's storm-petrel breeds in the far south and spends the austral winter in the north Pacific, Atlantic, and Indian Oceans. Seabirds are very successful at locating prey; in the Indian Ocean, tropicbirds select specific portions of the ocean to feed according to water temperature and salinity.

Seabirds have mastered an environment alien to humans, a realm that covers 75 percent of the earth's surface. The only requirement that brings them onto terra firma is that they must nest on shore. As enthusiastic as I am about pelagic trips, I'm practically apoplectic about seabird breeding colonies. These visits are incomparable experiences.

Imagine being in a teeming club of male great frigatebirds, with their inflated, red, gular pouches pointed skyward and swaying back and forth. The sight of an eligible female overhead causes the males to erupt in a frenzied display of outstretched, quivering wings and pulsating, swine-like whinnies. The cacophony may be deafening. With some luck, a female will swoop down to inspect a particularly impressive potential mate.

And then there are the penguins, perhaps the greatest spectacle in seabirding. My favorite is the pugnacious chinstrap penguin, 27 inches of unbridled personality. Chinstraps are closely related to gentoo and Adelie penguins, the two other brush-tailed penguins in the Antarctic region. By comparison, however, chinstraps are the most aggressive in defense of family and property. This bold animal fiercely approaches enemies and may attack with bill and flippers.

I won't forget a visit to a spectacular chinstrap colony at Deception Island near the Antarctic Peninsula. My presence was noticed by one chinnie who sauntered over to me, wildly flexing its flippers and croaking. I stopped in my tracks, dropped my camera bag, and returned an ecstatic display. It ceased its imprecations and we exchanged stares for a few minutes. The chinstrap then nodded its head, bowed deeply, turned and waddled away.

Savoring the moment, I vowed to return to these chinstraps and other seabirds wherever they may be found.

Judy & Art Bernhang

Ron Naveen and Adelie penguin

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THE AUTHOR

Ron Naveen is editor of *Birding,* the journal of the American Birding Association. He leads tours to the north Atlantic, the Galápagos Islands, and the Antarctic.

John Shaw (Bruce Coleman Inc.)

White-breasted nuthatch belongs to the bark-gleaners' guild.

Birds in a Patchwork Landscape

by Jeffrey K. Keller and Charles R. Smith

Why do birds live where they do? The search for an answer underlies much of the study of bird ecology.

CONSIDER the long-term consequences of abandoning a tract of farmland in the northeastern United States and allowing it to remain ungrazed or untilled for a century. Initially, the property will become populated by a whole new array of grasses and other herbs. After a few years shrubs and saplings will become established followed by the growth of the saplings into mature trees and, after many decades, a forest will appear where it once occurred before the land was cleared. Different species of birds and other animals will be associated with each new group of plants. This sequence of changes in vegetation and associated groups of animals is called ecological succession—a process which creates the mosaic of fields, shrublands, forests, marshes, and swamps you see when looking down on the earth from an airplane. Before early European settlers arrived in North America, natural processes accounted for landscape variety and successional change—fires ignited by lightning, floods caused by severe rainfall, forest clearings created by heavy windstorms or tornados, and swamps and marshes formed by beaver activities in our northern forests. Within this patchwork, why do birds live where they do?

The question seems simple but the search for an answer underlies much of the study of bird ecology. Take a well-known species like the red-eyed vireo. A quick check of its range map in one of the popular field guides shows that

Art Wolfe

A mosaic of habitats

in summer it is distributed over much of the continental United States and Canada. However, we know that within that broad geographic range red-eyed vireos are not found everywhere. Typically, they inhabit deciduous forests. Interacting groups of plants, birds, and other animals occurring together are called communities. Within the deciduous forest community, red-eyed vireos usually inhabit the tree canopy. Thus, exactly where a bird lives turns out to be much more restricted than a range map implies. The specific place where a bird lives within the community is called its habitat. It may be helpful to think of habitat as the address of a species within its ecological community.

After identifying the habitat of the red-eyed vireo we may ask—what does it do in the deciduous forest canopy that makes it best suited to live there? Ecologists refer to the functional role of a species within a community as its niche. In the same sense that habitat may be considered its address, niche may be thought of as the occupation of the species. In this case, the red-eyed vireo makes its living by searching among the leaves and twigs of the forest canopy for insects; it is a foliage-gleaner.

There are a number of other ways for birds to make a living as well as other places for them to live in the forest community. While it may be interesting to describe separately the niche and habitat of each bird species in the forest, community ecologists often are interested in identifying patterns of interactions among two or more species within communities. Because so many interactions are possible among the birds in an ecological community and the potential interactions among all the species in a community are virtually innumerable, ecologists have found it useful to describe and define units of organization that lie between individual species at one end of the spectrum and the total community at the other. By dealing with a subset of organisms, and hence interactions, researchers can better organize information and focus their questions regarding the structure and complexity of entire communities.

Joe Distefano (Photo Researchers, Inc.)

Solitary vireo is typically found in hemlocks and is a coniferous-canopy-foliage gleaner.

Guilds. One often-studied subset of the community is called the guild. A guild is a group of species using similar resources in similar ways, such as foraging for insects by gleaning foliage. The members of a guild do not have to be related. In the tropics, for example, if we study the guild of animals that uses nectar for food, we will observe hummingbirds, butterflies, ants, bees, and wasps that use the nectar resource by day, and moths and bats that search for nectar at night. The ecological concept of the guild is much like the term for describing medieval trade organizations. Groups of artisans with similar skills formed guilds to standardize labor practices, training for apprentices, and compensation for their labor. Several members of the same family might be in the same guild, but other families in the same town also could have members in the guild as long as they did similar work.

Patches. We referred to habitat as the address within the community where we find a particular bird species. Since the species forming a guild may use parts of several different habitats, it is also helpful for us to identify the parts of a community used collectively by guild members. To extend our earlier analogy, we need to identify the address of the guild. Within the community the address of a guild becomes the patch within which the various guild members interact and make a living. What might be some examples of patches and guilds? Let's look within a forest again, but this time let's choose a northern hardwoods-hemlock forest in the northeastern United States.

Within this forest of maple, beech, birch, and hemlock we may identify two kinds of patches and their associated guilds in the canopy. The deciduous canopy of maple, beech, and birch could constitute one patch while the coniferous canopy of hemlock would be another. We usually find the red-eyed vireo foraging for insects among the leaves and twigs of the deciduous canopy. Another species often associated with the red-eyed vireo, the scarlet tanager, might also be found gleaning insects in this patch. Other species making their living in a similar manner, but more typically found in the hemlocks, are the black-throated green warbler, Blackburnian warbler, and solitary vireo. These two guilds of birds may be described, respectively, as the

Wayne Lankinen

deciduous-canopy-foliage gleaners and the coniferous-canopy-foliage gleaners.

If two or more species in a guild fail to divide a patch into recognizable species-specific habitats, the potential for direct competition exists. However, competition among species sharing the same habitat may be avoided in several ways. For example, two different species may feed on different parts of vegetation, one on leaves, the other on twigs. Or they may feed in different ways—one may glean small insects from leaves, while the other hovers near leaves to seize larger insects. Or the species may feed at different times. The idea is that each species has a slightly different occupation—the niche concept we described earlier. Thus, two or more species may continue to coexist in the same habitat as long as their niches are different.

Returning to the northern hardwoods-hemlock forest, what other patches and avian guilds might be present? For the deciduous- and coniferous-canopy-foliage gleaners the patches included the leaves and small branches of the forest canopy. As far as these two guilds are concerned, the forest floor, tree trunks, and large branches of trees are different and unused patches. What avian guilds are using those patches?

On or near the forest floor two common birds are the wood thrush and the ovenbird. Two other species often found with them are the veery and the hermit thrush. Each may occupy slightly different habitats, but together they could be considered a guild that makes its living by foraging for insects on the ground and in low shrubs. Another guild is one of the most familiar. The downy woodpecker, hairy woodpecker, and pileated woodpecker are three widespread members of the guild of bark drillers and probers which makes its living foraging on the trunks and larger branches of trees.

So far we have described patches and guilds as if the kinds of patches and the members of guilds never changed. But because the landscape is constantly altered by wind, fires, floods, and human activities, as well as by ecological succession, we might expect patches to appear or disappear suddenly. Consider the consequences of a violent windstorm or tornado sweeping through a 100-acre tract of woodland, creating an opening (often called a blowdown) of approximately 50 acres. What new species of birds might appear during the following breeding season?

To answer this question we might try to predict what new patches would be created by the windstorm and, in turn, what guilds and species of birds might appear. For example, a blowdown creates openings of various sizes in the forest canopy as larger trees fall. The area between those openings and the remaining forest is called an edge. Edge is a border between adjacent communities of plants. However, none of the birds occurring along the forest edge use all of the edge, just as none of the birds in the forest interior use all of the forest. Guilds of birds need only the patch that provides them with opportunities to make a living.

One patch found along the edge is the interface between the canopy layer and the open air. That patch is beneficial to birds that sally forth from perches in search of flying insects. A guild member in such a patch is the eastern wood pewee. The windstorm has given the pewee a chance to join the community. This example demonstrates how even a modest increase in habitat complexity can lead to an increased number of species.

Patch Productivity. What other changes could take place in the northern hardwoods-hemlock forest community as a result of the blowdown?

Another patch created by the blowdown occurs at ground level. Within the first three to five years following the blowdown, tree seedlings, root suckers, and stump sprouts appear, forming a low and dense shrub layer. That patch is invaded by a rich variety and high density of foliage-gleaning insect eaters that are typical in this kind of vegetation. Among them are the common yellowthroat, chestnut-sided warbler, black-throated blue warbler, Canada warbler, mourning warbler, and gray catbird.

Grant Heilman

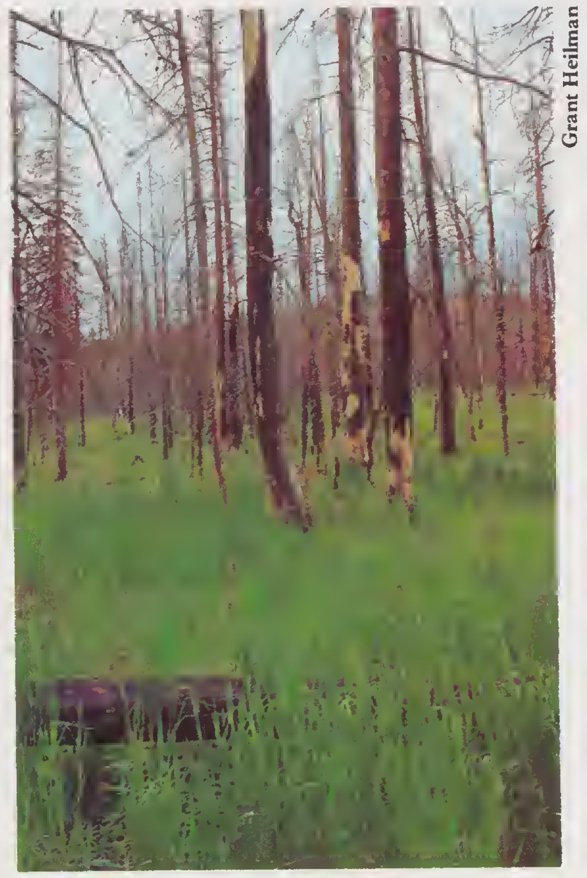
Recently, on the Connecticut Hill Wildlife Management Area near Ithaca, New York, Jeff Keller found that the early successional stages following a disturbance are characterized by an exceptionally high productivity of insects. Such an abundance of insect food leads to an increased number of bird species found in the resident guild.

In the case of the eastern wood pewee, the blowdown led to an increase in habitat complexity which resulted in a new species and its associated guild being added. In the second example, several new species were added to an already existing guild because of an increase in the quantity of food available. Thus, changes in either food quality or quantity or both can lead to the addition of species to a community.

Patch Size. If a windstorm can create new patches resulting in new species or new guilds, can it also cause the loss of patches and their guilds? Since the windstorm affected only 50 acres of our 100-acre forest, all of the patches within the original forest and all of their guilds might be expected to be intact.

But are these 50 acres large enough to support all of the resident species? How small can a patch be and still support breeding populations of its guild members? In the guild of bark probers and drillers, our 100-acre forest might support five or more pairs of downy woodpeckers, but might only provide for the needs of a single pair of the larger pileated woodpecker. There simply might not be enough foraging locations or food for the larger woodpecker to occur in greater abundance. After the windstorm reduces the forest to half its original size, how long would the pair of pileated woodpeckers last? Could they find enough food in the remaining tract of forest, or might they be forced to move to a larger woodland?

Recent studies by Chandler Robbins and his colleagues at the Patuxent Wildlife Research Center of the U.S. Fish and Wildlife Service have underscored the importance of area in maintaining a variety of species of woodland songbirds. Robbins's work has shown that some species are sensitive to the reduction in area associated with the cutting of forests and clearing of land. Such area-sensitive species include the red-shouldered hawk and barred owl and songbirds like the red-eyed vireo, scarlet tanager, and ovenbird. In heavily developed areas like the corridor between Baltimore, Maryland and Washington, D.C., where Robbins did his work, it appears that contiguous woodlands of 200 acres or more are necessary to assure that those species will be able to remain in the area. Smaller areas may not contain sufficient habitats or patches to support area-sensitive species and the guilds they compose.



Grant Heilman

Center: *Smoldering aftermath of forest fire.*

Above: *Three years later, a new array of lush herbaceous growth.* **Far Left:** *Downy woodpecker belongs to the bark-probing guild.*

Double-Edged Sword. Thus, we are confronted with a double-edged sword when deciding how best to manage dwindling wildlife preserves. Do we create and maintain a variety of different habitats for the greatest number of species, or do we leave intact as many acres of forest as possible for area-sensitive birds? Such questions are at the base of habitat management. The answers, however, are neither apparent nor simple, and are further complicated by the gradual but continuous changes occurring within communities over long periods of time—the process of ecological succession.

Birds exist within a landscape where habitat fragmentation from fire, flood, and wind has been augmented by human activities on a scale unprecedented in magnitude and frequency. Managing landscapes to prevent further loss of species or reductions in abundance requires a thorough knowledge of the dynamic interplay of ecological succession, habitat structure, size, and productivity, as well as species abundances in a human-dominated landscape. Birds are not the only component of that landscape, but they provide us with insights that may lead to a better understanding of the distributions and abundances of other organisms.

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BHL

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RESEARCH & REVIEW

by Richard E. Bonney, Jr.

Radioactivity Sensing

The canary in the coal mine has become a cliché. Nevertheless, the canary's sensitivity to carbon monoxide remains one of the best examples of an animal warning humans of unhealthy environmental conditions. When the canary died, the miners knew it was time to evacuate the mineshaft. In a similar manner, declining numbers of bald eagles and peregrine falcons over the last few decades warned us of unsafe pesticide levels in our environment. Now, studies by Reto Zach and Keith R. Mayoh of Atomic Energy of Canada Limited suggest that some birds can detect environmental radiation ("Breeding biology of tree swallows and house wrens in a gradient of gamma radiation," *Ecology*, vol. 63, pp. 1720–1728).

In 1973 a radioactive source was placed on a 70-foot tower at the Whiteshell Nuclear Research Establishment in Manitoba, Canada to examine the effects of chronic gamma radiation on a mixed boreal forest. The source produces a radioactive field which diminishes in intensity with increasing distance from the tower. The source is lowered into a shielded castle by remote control when researchers need to enter the study area.

The area is predominately aspen-birch parkland, with open meadows and willow thickets. Now, 10 years after the source was placed in the area, most trees within 175 feet of the tower have been killed by radiation, although other plants still abound. Beyond 300 feet, radiation effects on the vegetation are not obvious and may or may not exist.

Zach and Mayoh erected 250 tree swallow/house wren nest boxes in positions ranging from immediately adjacent to the source to about 1.3 miles away. They nailed boxes to trees, telephone poles, and stakes, attempting to space the boxes uniformly in and around similar appearing meadows. They measured the amount of radioactivity reaching each box by means of dosimeters stapled inside each box. In general, the farther from the source, the less radiation a box received.

Zach and Mayoh discovered that the 150 tree swallows and house wrens that nested in the boxes during two breeding seasons avoided boxes with high exposure rates. Furthermore, most of the birds that built nests in boxes with relatively high exposure rates abandoned the nests before laying eggs.

Did the birds actually sense the level of radiation? Was some coincidental factor involved? Or did the birds pick up cues from some secondary factor associated with radiation exposure, such as the amount of vegetation near each box?

To examine these questions, Zach and Mayoh measured several variables: height of the nest holes, direction (compass orientation) of the holes, and the amount of vegetative cover near and above each box. None of these factors seemed to influence nest-box selection. The birds used boxes with varying hole heights and directions, and both species rejected nest boxes with high exposure rates regardless of the amount of cover near the boxes. Of the remaining boxes with low exposure rates, swallows chose those with little cover, while wrens used the ones with heavy cover; two species with different habitat requirements responded identically to the radioactive exposure.

Zach and Mayoh also compared the amount of exposure of boxes used for breeding with several measures of breeding performance, including number of young fledged per nest and growth rate of nestlings. They found no significant correlations. However, the lack of correlations between radioactive exposure and breeding success may have been because the birds used only those boxes with radioactive levels low enough to permit successful breeding. It is interesting to note that the single tree swallow that nested very close to the radioactive source did not hatch its three eggs despite prolonged incubation.

This is not the first study to show that animals, including rats and certain invertebrates, can detect radiation. However, the method by which animals may detect it is unknown. And the question remains whether birds actually detect the radioactivity or if they sense some secondary characteristic, related to radioactivity, that the researchers thus far have not identified.

Song Stealing

The mockingbird is well known for its ability to imitate the songs of other birds, yet even its best replications are usually recognized as fakes by experienced birders. What about other birds? Are they fooled?

Eliot A. Brenowitz of Cornell University tested whether mockingbird imitations of red-winged blackbird song are good enough to deceive red-wings ("Aggressive response of red-winged blackbirds to mockingbird song imitation," *The Auk*, vol. 99, pp. 584–586). Using a tape recorder, he compared the responses of 10 territorial red-wings to red-wing song with responses to a mockingbird imitating a red-wing song. He discovered that most of the blackbirds showed strongly aggressive responses upon hearing the mimic song, just as they did when hearing the songs of other red-wings.

Brenowitz feels that this suggests that red-wings are unable to distinguish between songs of other red-wings and mockingbird imitations. Therefore, mockingbirds potentially could use their red-wing imitations to exclude blackbirds from mockingbird territories. Since mockingbirds and red-wings often eat similar foods, this could be a way for mockingbirds to dominate a food supply.

However, as Brenowitz points out, the study is not conclusive. The tape-recorded mockingbird imitations he used consisted of only isolated red-wing songs. Even experienced birders could be fooled by these. Normally, the mockingbird sings red-wing songs as part of a longer song-phrase that includes other bird songs. So, in a natural situation, red-wings may not always be fooled.

Further studies could answer this question. They also could examine whether other mimicked birds are fooled by mockingbird imitations. And they could shed light on other possible functions of song mimicry. Perhaps mockingbirds increase their song repertoires to attract mates better or to do a better job of advertising their territorial boundaries to other male mockingbirds.

Wild Park Ducks

People often think of park waterfowl as tame birds, eagerly awaiting a crust of bread or other handout from youthful visitors. However, H. W. Heusmann of the Massachusetts Division of Fisheries and Wildlife has discovered that some park mallards are truly wild, at least for part of the year (*Journal of Field Ornithology*, vol. 52, pp. 214–221).

Heusmann analyzed the seasonal movements of 269 mallards that he banded during winter in Massachusetts parks where ducks were accustomed to being fed by people. About 28 percent of the birds were recovered at least 60 miles from the parks where they were banded, indicating that they were only visiting the park at the time they were banded. Heusmann calls these ducks "wild migrants," or birds that reside in parks only during late fall and winter.

Approximately 60 percent of the ducks were recovered outside but nearby the parks; these are "local residents"—mallards that spend most of the year in a park but nest in nearby wild areas. Only about 12 percent of the banded birds remained in the parks throughout the year.

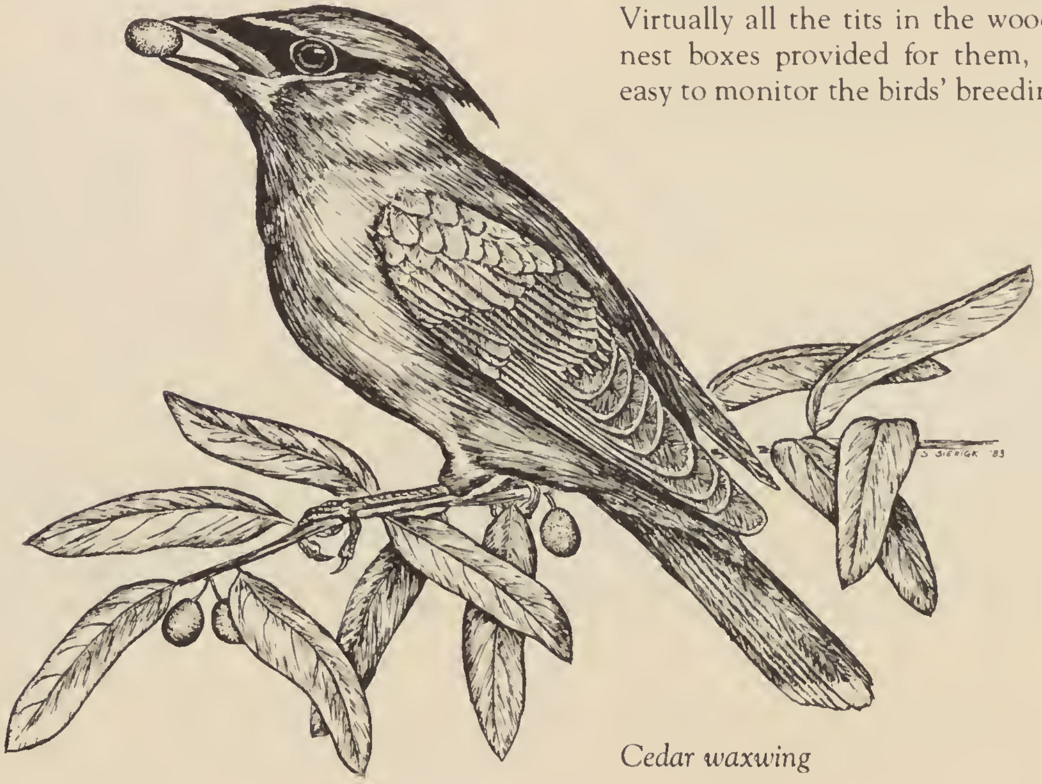
Because of the apparent importance of parks as wintering grounds for many wild-nesting mallards, Heusmann feels that any management plan for the mallard in the northeast must consider the role of parks in the mallard's ecology.

Deadly Plantings

Highway plantings make travel along otherwise boring, desolate stretches of roadway more pleasurable. However, Robert C. Dowler of Fordham University and Gustav A. Swanson of Colorado State University discovered they can be deadly to birds ("High mortality of cedar waxwings associated with highway plantings," *The Wilson Bulletin,* vol. 94, pp. 602–603).

Driving along the four-lane Highway 6 bypass near Bryan, Texas, they noticed several cedar waxwings being hit by cars. The birds were feeding on the fruits of silverberry, *Elæagnus pungens,* large, native shrubs planted along the median strip about 10 feet from the pavement. As cars passed, flocks of waxwings flew up, crossed the highway, and returned to the shrubs. Several birds were killed each time a flock passed over the road.

During the next month, Dowler and Swanson counted 300 dead waxwings along a two-mile stretch of Highway 6. The largest single count was 133 birds found one day in March along a 300-foot stretch of roadway. By the end of the month, only about 10 waxwings remained in the area.



Cedar waxwing

All of the dead birds that Dowler and Swanson found were near median plantings; they found no birds at plantings along sides of the highway or entrance ramps. The message seems clear: shrubs or trees that bear fruit or other foods attractive to flocking birds should not be planted along narrow median strips.

Speeding Sparrowhawks

How often have you heard that predators kill only old, feeble prey? This idea is a long-perpetuated myth that originated early in this century as part of a widespread attempt by conservationists to convince people that predators were not evil. This is true; they are simply doing what they have to do to stay alive.

It is also true that predators frequently kill old and feeble prey. To stay healthy, grow, and reproduce, predators must not waste their energy. Therefore, they usually concentrate on prey that are easiest to capture; often these prey are young, old, weak, or diseased members of a population.

But predators do not always eat the weakest prey. Usually, a predator will kill any prey it can capture. Many predator-prey interactions are the result of chance encounters and, under favorable conditions, a strong, healthy predator may be able to capture almost anything.

New evidence for this fact comes from a recent study by Timothy A. Geer of the Edward Grey Institute of Field Ornithology, Oxford, England. Geer studied great and blue tits preyed upon by sparrowhawks, European relatives of our sharp-shinned hawk. They found that killed birds differ very little, if at all, from their counterparts that are not captured ("The selection of tits *Parus* spp. by sparrowhawks *Accipiter nisus,*" *Ibis,* vol. 124, pp. 159–167).

Geer worked in Wytham Wood, England, home of several pairs of sparrowhawks and dozens of great and blue tits. Virtually all the tits in the wood breed in nest boxes provided for them, making it easy to monitor the birds' breeding. During breeding season, all nest boxes are checked regularly and records are kept for several brood and physical characteristics, including the number of the band given to each nestling bird. Age, sex, and band number also are recorded for adults captured near their nest boxes.

To discover which individual tits were captured by sparrowhawks, Geer collected hawk pellets from nine sparrowhawk nests. Pellets are indigestible parts of prey, such as bones, beaks, and claws, that a hawk regurgitates a few hours after eating. The sparrowhawk pellets also contained the bands of tits that the hawks had eaten. After the breeding season, Geer removed and dissected the hawks' nests to recover bands that had become lodged inside.

Over a three-year period, Geer made three kinds of comparisons to see whether certain types of tits were captured more frequently than others. First, he compared characteristics of individual fledgling tits killed by sparrowhawks with average characteristics of fledgling tits, including brood size, hatching date, and individual weight. Second, he compared characteristics of killed adult tits with average characteristics of the adult population, including sex and time of nesting. Third, he compared hawk selection of young versus adult tits.

Geer discovered that young tits killed by sparrowhawks did not differ significantly from the general young population, except young blue tits killed in the second and third year of the study were those that had hatched slightly later in the season. Geer speculates that the hawks may have captured more late-brood young because they were still in family groups and therefore more vulnerable than earlier brood birds which already had dispersed into the thick cover of the tree canopy.

There also were no significant differences between killed adult tits and the average adult population, except that hawks tended to select male great tits slightly more frequently than females. Geer suggests that this is because males are more conspicuous when foraging or defending their territories.

Finally, for both species, Geer found that hawks captured young more frequently than adults only during the study's second year. This may have happened because during the second year there were far more tits living in the wood; although the ratio of young to adults did not change from year to year, the sheer number of young birds present during the second year may have increased their vulnerability.

Geer concludes that the sparrowhawks were largely unselective in capturing their prey. This probably results from the sparrowhawk's method of attack: it lies in wait or dashes into a group of prey from cover. A surprised tit, even a healthy one in the prime of life, has little chance to escape a speeding sparrowhawk.

NEWS & NOTES

Dear Member:

I would like to take this opportunity to thank you for helping us achieve a year of tremendous growth. Two years ago our membership barely reached 3,000. With so little money coming in, our research and education programs had to be stripped to the bone.

Then we decided to suspend publication of our technical journal, The Living Bird, *in order to fund a new magazine which would be geared to a larger audience. Our idea was that people interested in reading the* Quarterly *might want to become members. And the larger our membership, the more extensive and effective our research and public education.*

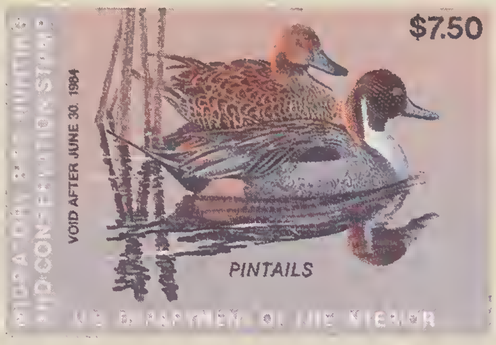
With much holding of breath and wringing of hands, we waited for news about the Quarterly *to spread. At last we are beginning to see some results; our membership is now near 6,000, with 700 people signing up in May alone. We hope to have 10,000 members by this time next year.*

What, you may ask, do we hope to do with our support dollars? If our finances continue to improve, we would like to increase our services to members—by expanding the Quarterly *and perhaps resuming occasional publication of a technical journal. We hope to improve our art gallery and add to our interpretive exhibits at Sapsucker Woods Sanctuary. If we can find the initial funding, we have high hopes for national distribution of our new radio program, "Song and Flight." We also would like to sponsor more international tours, similar to our current series to East Africa.*

Besides enhancing our services, we wish to extend our research programs. At the top of the list is our desire to transfer nesting and breeding data to a computer so that anyone studying the reproductive success of selected bird populations can do so quickly and comprehensively. Other plans involve the analysis and synthesis of natural sounds, and habitat studies of areas under particular stress from land development. Continued growth of our membership is the key to our taking these initiatives.

Your dues, gifts, and bookshop purchases provide more than half our income. By joining with us you have not only made our continued existence possible, but have allowed us to plan an exciting future which we hope all of you will share.

CHARLES WALCOTT, *Executive Director*



An acrylic painting of a pair of pintail ducks on water won the 1983–84 federal duck stamp competition. It was painted by Phil V. Scholer, a professional wildlife artist from Kasson, Minnesota.

Scholer had entered the federal competition on four previous occasions, placing high in the judging but never winning. This year, however, his entry topped 1,563 other paintings during the two days of judging at the Department of the Interior.

His design will be reproduced on this year's Migratory Bird Hunting and Conservation Stamp, which must be purchased by all waterfowl hunters 16 years of age and older in the United States. The design for each year's stamp is selected through a national contest. Revenue from the sale of the duck stamp is used to buy wetlands and other types of waterfowl habitat under a program administered by the U.S. Fish and Wildlife Service.

Alexander F. Skutch is winner of the 15th Arthur A. Allen award for his outstanding contribution to tropical ornithology. The award was presented at the centennial meeting of the American Ornithologists' Union in September.

Dr. Skutch became deeply interested in tropical birds while doing research in Central America in 1928 and, since no support for studying them was available in the depression years, he paid his own way, largely by collecting and selling botanical specimens. After doing this for about eight years he bought a farm in Costa Rica and settled there in 1941 to continue his studies.

His writing includes: *Life Histories of Central American Birds* (1954), *Life Histories of Central American Highland Birds* (1967), *Studies of Tropical American Birds* (1972), *Aves de Costa Rica* (1977), *A Bird Watcher's Adventures in Tropical America* (1977), *The Imperative Call: a Naturalist's Quest in Temperate and Tropical America* (1979), and *A Naturalist on a Tropical Farm* (1980).

Dr. Skutch writes, "I am greatly concerned about man's destruction of nature.... To know, appreciate, and preserve all the beautiful and wonderful things our planet contains is, in my opinion, the proper end of man."

The Cornell Laboratory of Ornithology established the award in 1966 in memory of Arthur A. Allen, ornithologist, teacher, and co-founder of the Laboratory.

Early last June three peregrine falcon chicks hatched under the Verrazano Narrows Bridge and two under the Throgs Neck Bridge. The parent birds were raised in captivity and released by Cornell University's Peregrine Fund. This is the first time since repopulation efforts began in 1970 that the endangered species has hatched in New York City.

The nests were discovered last spring by bridge maintenance workers who witnessed characteristic nest-defense behavior—diving, screaming birds that warned them to keep their distance.

If all goes well for the chicks, they may eventually return to the area to raise young of their own.

The Laboratory is pleased to announce the appointment of four new members to its administrative board. They are Robert Barker, vice president for research and advanced studies at Cornell University; Clifton C. Garvin, Jr., chairman of the board and chief executive officer of Exxon Corporation; Mrs. Harvey Gaylord, life member and former administrative board member of the Laboratory, and Joseph R. Siphron, member of the law firm of Milbank, Tweed, Hadley & McCloy.

Ron Naveen will be leading a tour January 4 to 29, 1984 to the Falkland Islands, South Georgia, South Orkney Islands, South Shetland Islands, and the Antarctic Peninsula on the M. S. Lindblad Explorer. See numerous seabirds and multitudes of nesting albatrosses and penguins. For more information write: Salén Lindblad Cruising, 133 E. 55th Street, New York, New York 10022, or call (212) 751-2300.

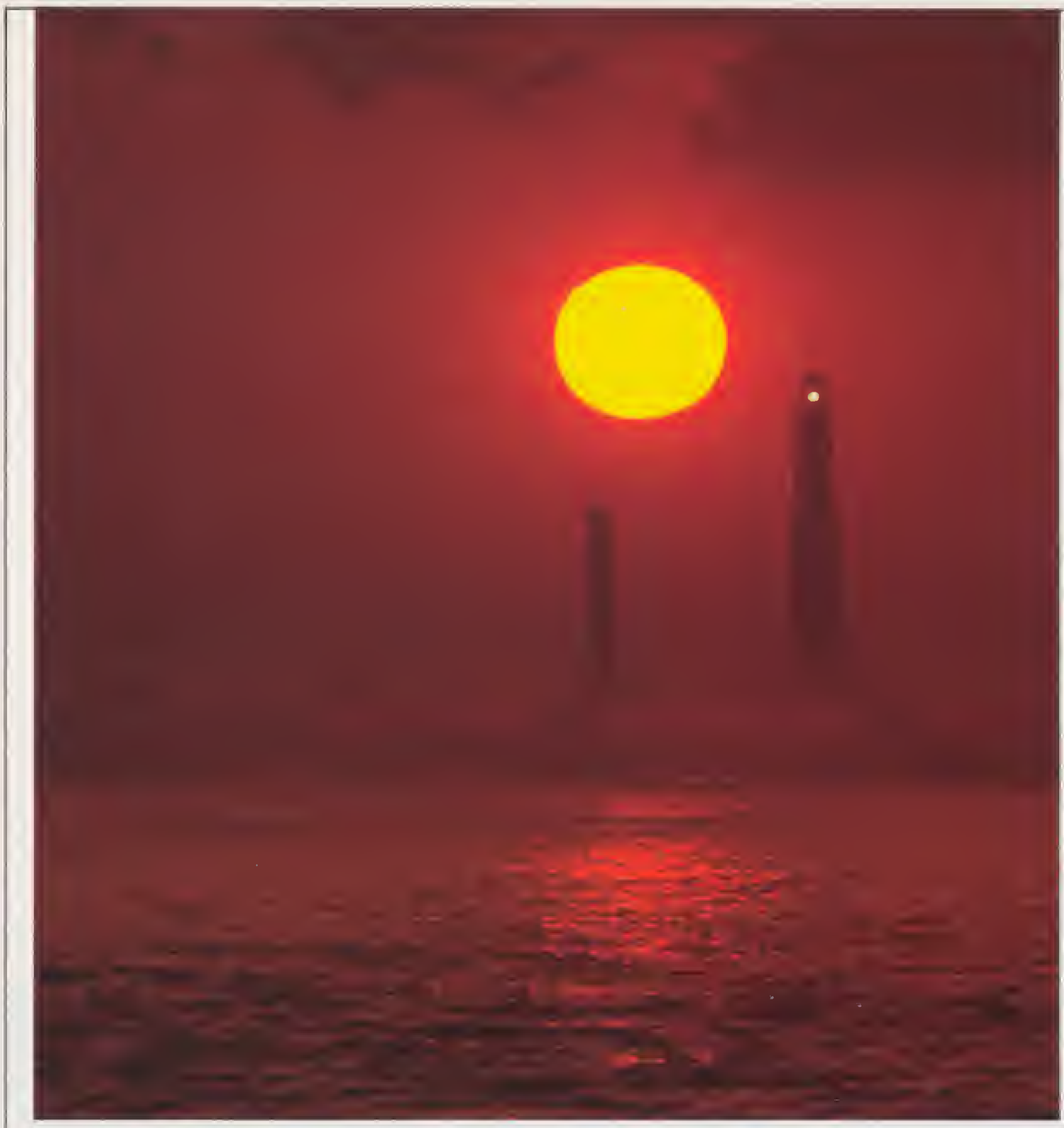
Marion McChesney, wife of Donald McChesney, died on June 24, 1983, just a few months after Mr. McChesney's death.

Mrs. McChesney assisted her husband on all his expeditions, including those devoted to the sound recording and filming of birds of North and Central America, Africa, and England on behalf of the Laboratory of Ornithology. In 1956 she was appointed a research collaborator of the Laboratory.

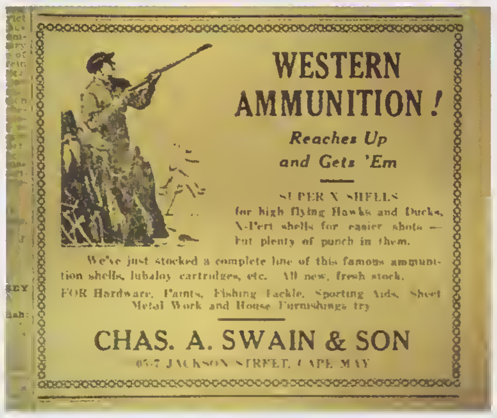
The McChesneys were retired and residing in Beaufort, South Carolina. They were both active supporters of the Laboratory since its inception and surely will be missed.

Mecca on the Migration Mainline

by Pete Dunne



Pete Dunne



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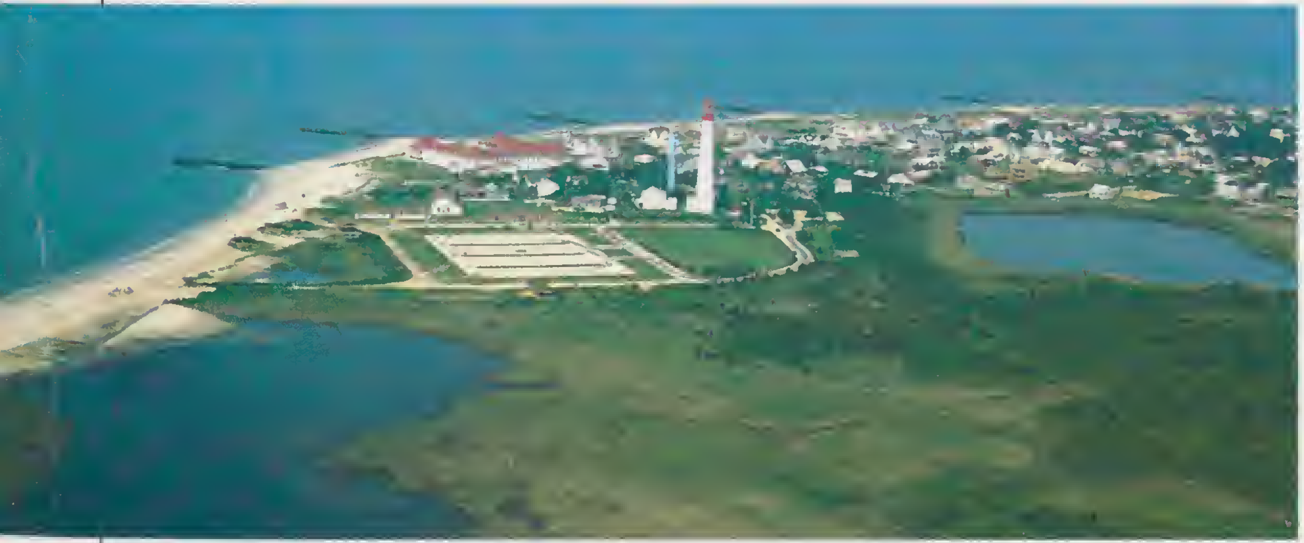

Pete Dunne

Impressions of Cape May. ***Top:*** *Sunset at Cape May Point.* ***Center Left:*** *A 1938 Cape May newspaper advertisement.* ***Center Right:*** *Peregrine falcons are common visitors.* ***Bottom:*** *Cape May Peninsula offers dry footing on an otherwise wet stretch of planet.*

THEY LINED THE ROAD north of Cape May Point just before dawn; locals in Plymouths and Fords, sports down from Philadelphia in Packards. Over the whine of wind in the pitch pines, you could catch snatches of conversation, voices taut with anticipation, and the sound of car doors slamming. As the sky behind the lighthouse brightened, other sounds sharpened the chill October air: the crisp, slick ring of a shell chambered into a pump shotgun, or the soft, uncompromising snap of a double being closed.

They were gunners and they came for the hawks that came with the northwest winds of autumn. They came for excitement, to test gunning skills grown stale from a summer's disuse, and for the camaraderie that accompanied the great autumn hawk shoots at Cape May, New Jersey.

The shoots are history now. The pines that flanked the road are gone. But the wind returns each fall—and the birds. And so do the cars that line the roads of Cape May Point before first light. Some belong to locals. Others bear plates that span the continent and belong to birders who come to Cape May to observe and enjoy the hundreds of thousands of birds that pass in migration—the birds that have made Cape May synonymous with fall migration.

Just how long birds have been threading the length of Cape May peninsula is not known, but it hasn't been long in geological time. Cape May itself is only about two million years old. Why birds concentrate here is no secret. Cape May has a geographic position that lies between the breeding ranges of many northern and southern species and it stretches out along the eastern edge of a continent of prevailing westerlies. It also has a diversity of habitats that can accommodate many species.

"But," you say, "other places can claim these advantages that are not a migratory junction." One other feature about Cape May comes into play. It is a peninsula, a long narrow extension of the New Jersey coastal plain that reaches out between the Atlantic Ocean and Delaware Bay. Each fall the Cape becomes a giant funnel, catching and directing southbound birds to its terminus at Cape May Point. Some species, like the broad-winged hawk, are directed here because they shy away from the rigors of a water crossing. Any broad-wing that misjudges the intensity of the northwest wind and misses Bermuda does not have another place to land until it reaches the Ivory Coast.

But even species of land birds that show little reluctance to migrate over long distances of open water still must rest and feed en route. For these, Cape May offers the only dry footing on an otherwise wet stretch of planet. When nocturnal migrants begin landing after midnight, they concentrate along the length of the peninsula, bounty for birders.

Townsend P. Dickinson (Photo Researchers, Inc.)

Hawk watching

Human interest in Cape May's birding wealth antedates the arrival of the European invaders if the finely worked quartz and flint arrowpoints that sprout from new-plowed fields each spring are any evidence. Written accounts by early settlers mention large numbers of "bustards, swans, geese and fowls" but not thrushes, warblers and the like, suggesting, perhaps, an adoption of the Indian's practical interest in the region's avifauna.

Bird counters

George H. Harrison

Today, if you avoid the suburban sprawl that characterizes the Atlantic side of Cape May and make your way along the bay shore, you will meet shareholders in the Cape's heritage, people who can trace their lines back to men who held charters from kings: oystermen and gill netters, commercial fishermen, cedar cutters and salt hay farmers. They talk with a deep knowledge of the "cranes" (egrets) of the marshes, of the "summer" (laughing) gulls, and the "winter" (herring) gulls and, when the spring tides flood the marshes, about the awesome concentrations of shorebirds that feast upon the bounty of horseshoe crab eggs—"red-breasts" (knots), "calicos" (willets), and the "bumblebee beach birds" (sanderling/semipalmated sandpipers). (Lumpers are not a new phenomenon.) And you will recognize in these people their deep-rooted oneness with this land of black ducks and blue mud, the calm assurance of those who have learned to live in harmony with the tides.

Alexander Wilson made a number of trips to Cape May accompanied by his friend and birding sidekick George Ord. In 1813, Wilson collected both a male and female of a bird new to him in the area called "Cape Island." Ord, who was with him that day, named the bird "Wilson's plover." Ord himself was responsible for collecting a small passerine in 1809 which defied known descriptions and was named by Wilson "Cape May warbler," the same common name it carries today.

Audubon painted in the marshes just north of Cape May, Spencer Baird (of sparrow and sandpiper fame) made extensive forays into Cape May, and Witmer Stone, Cape May's birding patriarch and a leading ornithologist of his day, set down his vast knowledge of Cape May's bird life in his two-volume work *Bird Studies at Old Cape May.*

Then in 1976, the New Jersey Audubon Society established the Cape May Bird Observatory. Cape May's reputation as a mecca on the birding circuit grows yearly and as its fame increases so does the number of its proponents. If you were to stand in the shadow of the Cape May lighthouse during the last week in September and not wear binoculars you would be in a minority. The list of birders present would read like a *Who's Who in North American Birding.*

Many are veterans of multiple seasons here, their arrival and departure dates as predictable as the birds themselves. You saw the same faces in High Island/Galveston, Texas in April, and Point Pelee in May. Now their paths carry them south with the flow of autumn migrants. But many more are first timers, drawn by written accounts or the insistence of a Cape May advocate that this is *the* place to be. The atmosphere is festive. Rumors of a "good" bird are tracked down by hopeful tour leaders. Information is traded freely; one Connecticut warbler report for the location of a western kingbird and the rumor of a Baird's sandpiper.

The hawk watch platform at Cape May Point State Park has become the marketplace for the barter of information as well as a place for birders to plant their feet in the flow of the day's events and not lose any prime birding time. Overhead is the Cape May hawk flight, known to exceed 75,000 birds during most years with some estimates doubling or tripling that figure.

Pete Dunne

Cape May sparkles with sand and sunlight.

Since 1976, Cape May Bird Observatory has maintained a raptor count at the Point. The first took place from a makeshift elevated tabletop. Now, eight years later, the peak-season crowd of hawk watchers crams the sturdy 90-foot platform that each season becomes a little less adequate. That first count of 48,000 hawks in 1976 took the North American hawk-watching community by surprise. The figure, thought to be too high, met with skepticism and in some cases derision. The impact of DDT upon raptor populations was still being felt. Numbers that doubled the annual totals from ridge hawk watch sites such as Raccoon Ridge or Hawk Mountain, were considered overly optimistic. Many feared this would be interpreted as a premature recovery in pesticide-stressed populations and would cause a relaxation of protection standards. A hawk count conducted at Cape May by Ernest Choate in 1970 which included a count of 105 peregrine falcons was doubted in print by Donald Heintzelman in his *Autumn Hawk Flights.*

It was partly in the hope of getting to the heart of the rumor that brought hawk watching's godfather Maurice Broun, Hawk Mountain Sanctuary's curator emeritus, to Cape May, and this is when I met him. We stood elbow to elbow overlooking the foxtail and the waning afternoon flight, trading banter and shoptalk, the new kid on the block and the grand old master.

Maurice asked about the flight, pointed questions about its pattern and the problems of counting birds in a cul-de-sac. As we spoke and watched, Maurice got caught up in the flight, in its subtleties, the patterns of different species—accipiters along the wood's edge, falcons down the beach, harriers overhead, buteos cutting the corner on the Cape and turning north. Waves of birds moved through in pulses and as his excitement increased his skepticism dissipated.

A new wave of raptors moved through and I swept my binoculars along the treeline, clicking off sharp-shinned hawks and a stray Cooper's hawk. I spun around to work the beach and to record birds passing to our right. Maurice held to the woods north and after a flurry he turned and asked if I had seen the harrier and the half-dozen sharpies. "No," I admitted, but had he seen the eight kestrels and merlin that had moved down the beach?

"No," he replied, and then a smile crept over his face that made it clear

Ted Swem

Pete Dunne

BHL

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that he was now another Cape May advocate.

Comparisons between Cape May and Hawk Mountain Sanctuary, Pennsylvania are inevitable and slow moments on the watch at both mighty migratory junctions are often filled with good-natured debate about "which site has the better overall flight" or "which offers closer looks at birds of prey." To my mind, the Cape and the Mountain are two sides of the same coin. Hawk Mountain is steeped in the timeless dignity of the Kittatinny Ridge, the endless mountain of the Lenape Indians. Its birds are spirits in league with the mountains, the broad-winged wind masters like the red-tailed hawk and the golden eagle.

Cape May sparkles with sand and sunlight, reflecting the dash of accipiters in the trees and the laser flight of a merlin. In the past eight years the Cape May hawk watch has racked up a set of raptor statistics that has made many a grizzled hawk-watch veteran push back his or her visor and whistle in unabashed awe. And for ardent hawk watchers, Cape May has become a must stop, either on their way to or from their annual pilgrimage to Hawk Mountain—two grand autumn phenomena as different from each other as mountains and shore.

But more than just a place to observe tremendous numbers of birds, Cape May is a famous rarity trap, where the bird out of place is the norm, not the exception. Peninsulas and other last points of land have a way of attracting the wayward bird, and Cape May shares this happy circumstance with Pelee in Ontario, Cape Cod, Massachusetts, Monhegan Island off the coast of Maine and Block Island off Rhode Island. It makes perfect sense. Where you have large concentrations of birds you are likely to encounter the odd-bird stray, out of touch with time and place.

The trouble with living on a vagrant trap like Cape May is that the observer develops new standards about what constitutes an unusual sighting—standards out of line with the mainstream of birding. Seasoned members of the Cape May birding block would hardly lengthen their strides to intercept a wanderer such as a western kingbird or a Swainson's hawk. Even rarities like an eared grebe, Franklin's gull or wheatear are taken for granted.

To really rock the inner circle at Cape May, it takes a genuine avian anomaly: a brown booby, European kestrel, or great snipe. Then there are the sightings that are spoken of only in whispers to a close friend. Credibility is a little like virginity—you lose it only once. There are birds that could shatter an otherwise unblemished reputation, a European sparrowhawk, for instance, or a greater golden plover. (Not, of course, that they have ever been proven. Certainly not!)

But even by Cape May standards, hawk watcher Fred Hamer is a marvel of unconcern. In 1981, amid 400 birders, a rare wheatear perched atop a picnic pavilion some 200 yards from the hawk watch platform. Pressed for an identification of the distant silhouette, Fred allowed it to be "some kind of thrush" and returned his attention to the hawk flight.

If you are interested in experiencing a little of fall in Cape May, you can pretty much pick any date. Fall begins June 25 with the southward passage of the first lesser yellowlegs and ends in February with an influx of common redpolls. Most birders cannot work nine months of autumn into their schedules and choose to arrive from mid-August through October, the period of peak numbers and diversity.

Shorebird numbers run keen early in the season, from July through August. Fall warblers peak during the last week in August through mid-September. The peak of the hawk flight occurs during the last week in September through October. Waterfowl and seabirds make their run in November and December.

If your vacation is only a few weeks long, I would suggest a trip to the Cape when September brushes October, a time of year that offers the greatest species diversity. Twice in the 37-year history of the New Jersey Audubon Society's annual Cape May Autumn Weekend, the species list for the three-day event crested to 200. A few organizations arrange fall trips to Cape May and several tour groups offer peak-migration package tours, including Cape May Bird Observatory and Cornell's Adult University.

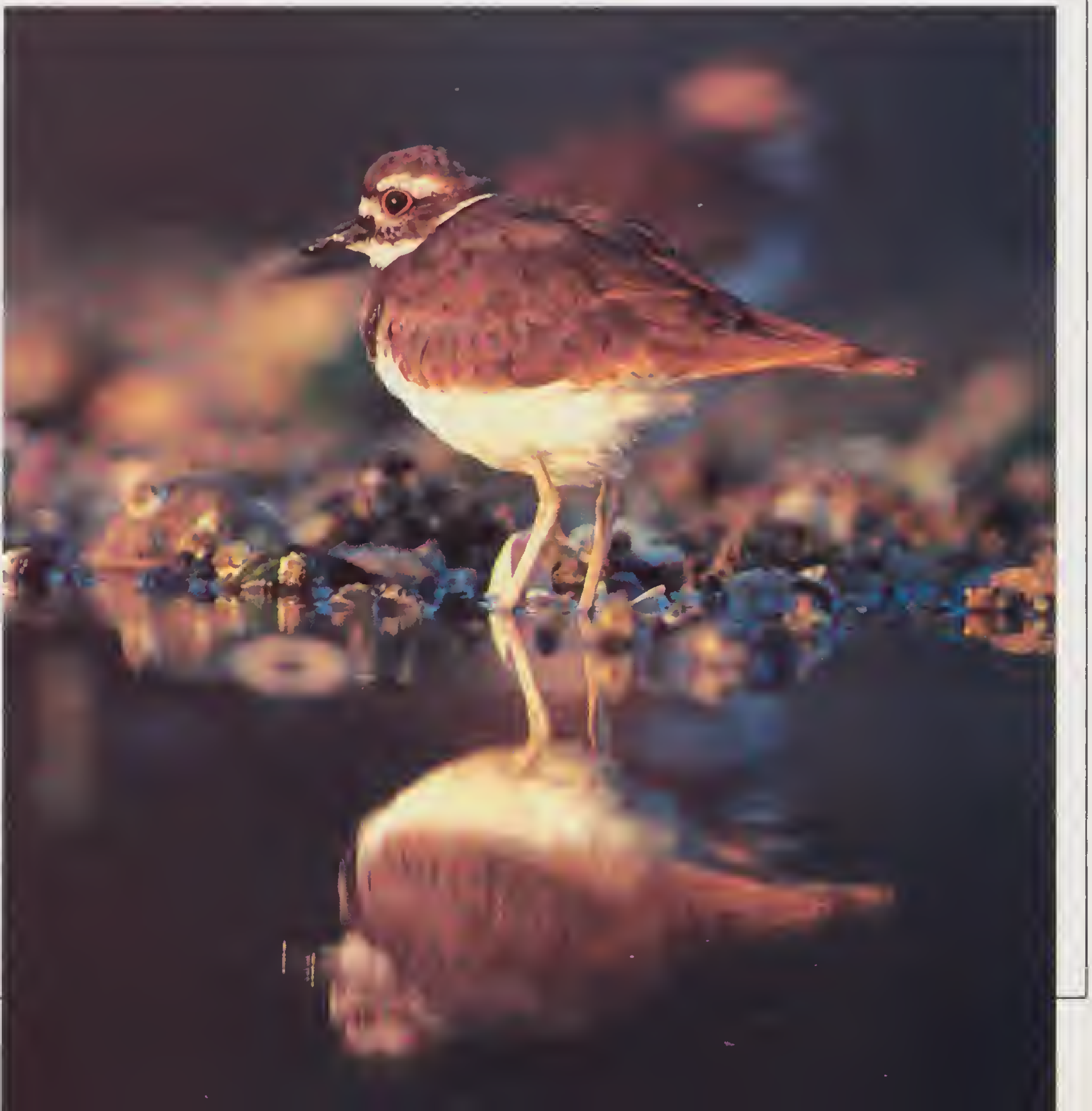
I could say a whole lot more about Cape May and its birds. I haven't even mentioned spring migration. But that's another story.

FURTHER READING

Teale, Edwin Way. *Autumn across America.* Dodd, Mead, New York. 1956.

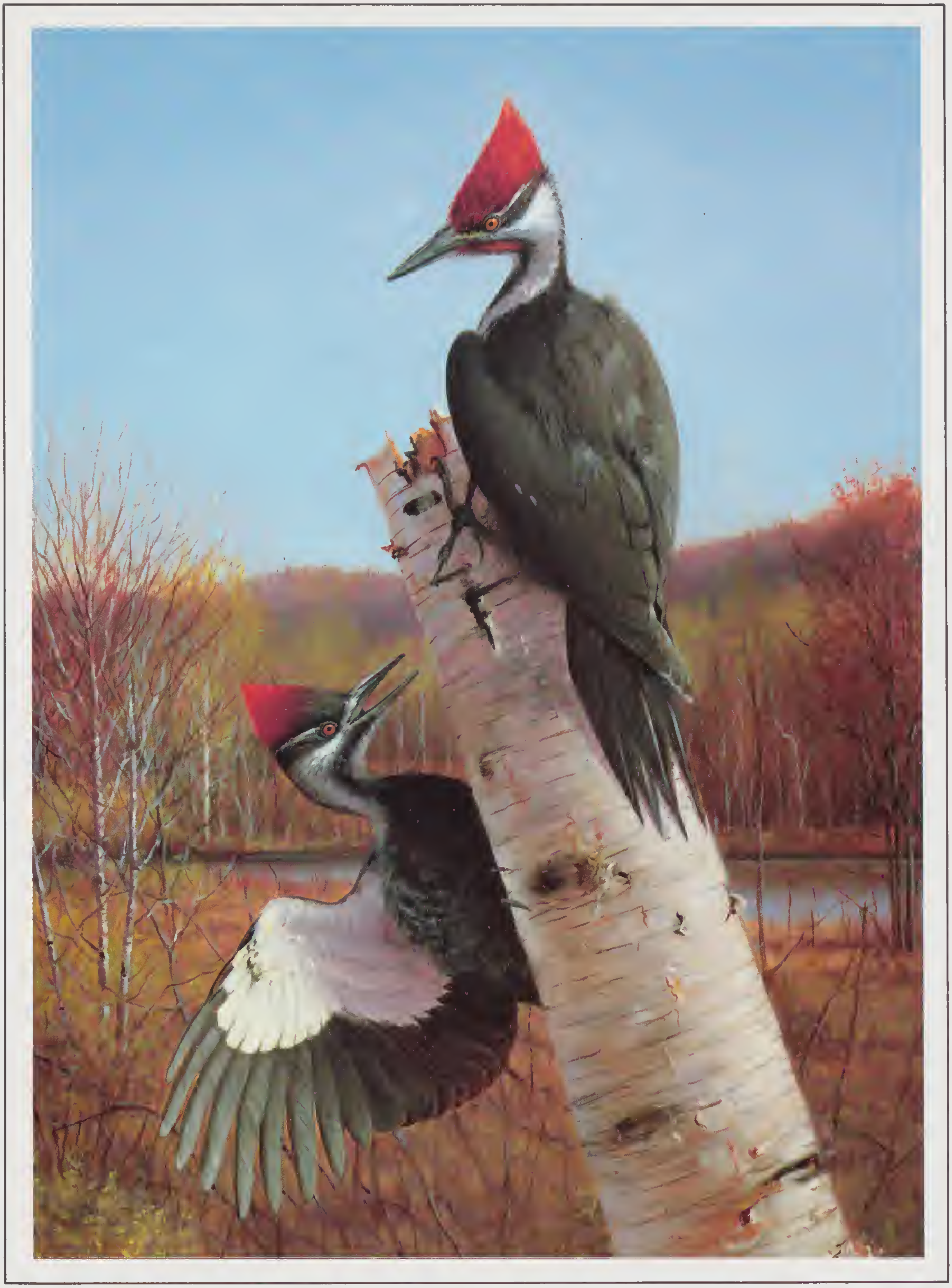
THE AUTHOR

Pete Dunne is director of Cape May Bird Observatory.



Killdeer seek the borders of inland pools or remote brackish ponds.

Tim Fitzharris



Owen J. Gromme
Courtesy of the artist and Stanton & Lee Publishers, Inc., Madison, Wisconsin

THE LIVING BIRD QUARTERLY

Winter/1984

Laboratory of Ornithology
159 Sapsucker Woods Road
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Steve Maslowski

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Volume 3 Number 1

THE LIVING BIRD QUARTERLY

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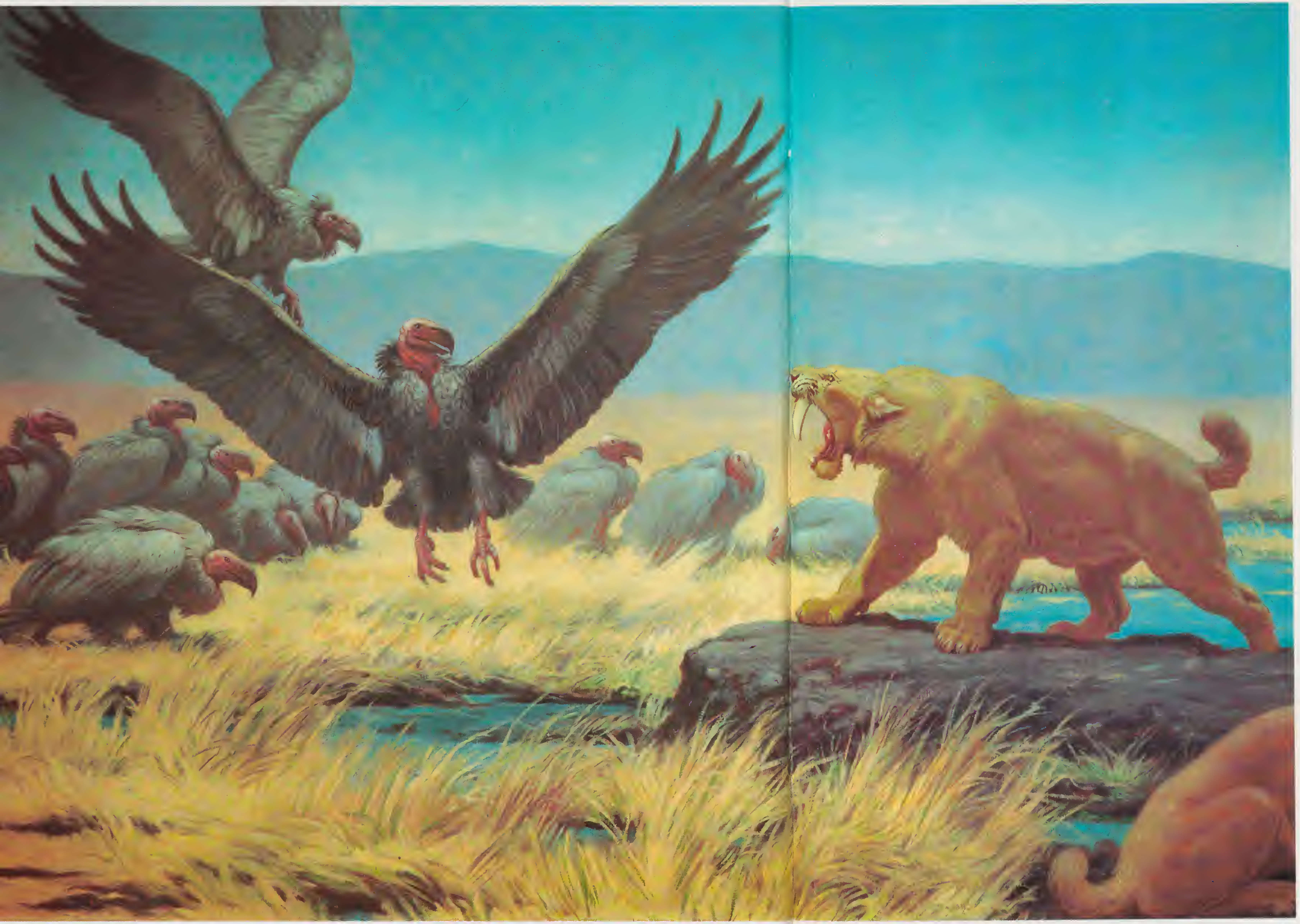
FRONT COVER. Golden eagle, western Montana. Photograph by Alan Carey.

BACK COVER. Immature blue-footed booby. Photograph by David O. Johnson.

Pleistocene drama: saber-toothed tiger encounters teratorns, ancestors of the California condor, the "bare-headed vulture of California."



Mural by Charles R. Knight. Courtesy of the Field Museum of Natural History, Chicago.

Bare-headed Vulture of California

by Dean Amadon

I ONCE EXAMINED a manuscript in the Bishop Museum in Honolulu that represented the lore of an old Hawaiian native as recorded by an early missionary. The opening sentence of the section on birds has stuck in my memory: "In Hawaii dwell many birds—some large, others despicably small!" Now whatever one might say about the California condor it would never be called despicably small. Some whooping cranes may stand a few inches taller, some trumpeter swans or turkey gobblers weigh a few pounds more, but with its broad wings reaching to nine feet and beyond and weighing 20 or 25 pounds, *Gymnogyps californianus*, the bare-headed vulture of California as it is called will, along with its cousin the Andean condor, be on anyone's list of the half-dozen largest flying birds.

If we could turn the clock back a few million years we would be in the golden age of mammals when mastodons, giant ground sloths, saber-toothed tigers and other impressive beasts roamed our continent. Among the scavengers which evolved to feast upon their remains was the California condor. At that time it ranged across the continent; its fossil bones have been found in Florida. Perhaps these were young birds which later retreated to the nearest mountains to nest; the condor does not mature until it is six to eight years old.

The Ice Age put an end to this mammalian Garden of Eden. Most of the big mammals went and with them went their predators and scavengers includ-

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The harpy eagle is another large, rare bird with a leisurely reproductive rate. Right top: The elephant seal, believed extinct at the turn of the century, has abnormally low genetic variation. Bottom: The king vulture is cousin to the endangered California condor.

ing the huge teratorns, relatives of the condors. The California condor survived, though in a greatly reduced range, along the west coast from the Columbia River where Lewis and Clark saw it, south to the mountains in Baja California, Mexico, just below the border. More recently its distribution, as a result of shooting, poisoning and deterioration of habitat, has become even more restricted and now it is found only in the coastal ranges of southern California. Its numbers have continued to decline: today about 20 individuals are left in the wild and nine in captivity.

The California condor is thus a relict species, one whose range has shrunk dramatically. Relicts occur at all levels of classification: the ginkgo tree, Latimeria fish, and duck-billed platypus, are relicts of groups that reached their zenith millions of years ago and seem to be disappearing. On the other hand Kirtland's warbler, which nests only in a restricted area in Michigan, is a recent relict, a member of the same genus that includes our common warblers such as the yellow warbler.

Some would say that the California condor is a Pleistocene relict on its way to extinction from natural causes and would find no justification for going to great lengths to prolong the supposedly inevitable decline. One may answer such seers by emphasizing how incredibly brief, in geological terms, has been the presence on earth of civilized man with a written record—a mere five or six thousand years. If modern man with his guns and poisons had not appeared in North America, there is no reason why the California condor, scavenging upon deer, elk, and seals, might not have existed for another 50,000 or 100,000 years, or perhaps for ten times that long. And where will mankind be after another 50,000 or 100,000 years? Perhaps flourishing, perhaps sadder but wiser, perhaps deader than a dodo.

No species is doomed to extinction if a breeding nucleus exists, no matter how small, and if no irreversible genetic deterioration sets in. This is not to deny that some species are more likely candidates for extinction than others. The duck-billed platypus is not only a living relict of an ancient line of egg-laying mammals, it is also highly specialized which always makes long-term survival less likely. Still, one cannot be absolutely certain that some pestilence or calamity, man-induced or natural, will not wipe out the higher mammals and leave the scene once again to the egg-laying monotremes. Vulnerability is found in strange places. One would not have expected the passenger pigeon, once the most numerous bird in North America, to have succumbed to persecution with shocking rapidity—its Achilles' heel perhaps an ingrained compulsion to nest in colonies, and for the stragglers to seek colonies when they no longer existed.

The California condor population, while not necessarily doomed, certainly is endangered by its extremely small size. The old belief that inbreeding is harmful has a sound basis in genetics. In a very small population harmful genetic effects can spread throughout the population purely by chance. An unbalanced sex ratio also can become established by chance as in a large family of all girls or all boys. In a species reduced to very small numbers this can be especially harmful.

Just how small a population can be before encountering adverse genetic effects or chance deterioration depends upon a number of factors in part unknown or little understood. The fact that the condor is a long-lived bird helps—it can live for 30 to 50 years. On the other hand, a small songbird such as the endangered Kirtland's warbler is surely in trouble now that its population is less than 1,000 individuals.

Some birds and mammals have fallen to a very low population and then recovered nicely. The American bison is one. A more spectacular example is the northern elephant seal. Believed extinct at the turn of the century, about a dozen escaped the sealers on the inhospitable coasts of the Mexican island of Guadalupé. The small nucleus bided its time for a few decades, then began to mushroom and now there are several hundred thousand of these huge seals with new colonies appearing every few years. Even so, tests by Dr. R. K. Selander of the University of Rochester have shown that the amount of chromosomal variation in this seal is far below what is normal in its relatives. We may safely say that a species that remains below 100 individuals for any appreciable length of time, perhaps a century in long-lived species such as the condor or the whooping crane, is almost certain to be doomed by the spread of deleterious genetic combinations. How large a population is needed for genetic health is debatable, but 500 would seem minimal.

The California condor first nests when it is six to eight years old; the courtship, incubation and care of the single young are so protracted that nesting usually is attempted only every other year. How did such an extremely slow rate of reproduction ever evolve? The question acquires greater pertinence in view of the evidence first set forth by David Lack of Oxford, that natural selection will always favor the maximum number of eggs and young which can be nurtured successfully.

The leisurely reproductive rate of the condor is matched by fewer than 10 of the world's roughly 9,000 species of birds. One is its cousin the Andean condor and perhaps the king vulture as well. Some of the largest eagles such as the harpy also have a cycle in which nesting takes place only once every other year. The same is true of two of the largest albatrosses and of the king penguin.

George Holton (Photo Researchers, Inc.)

Kenneth W. Fink (Bruce Coleman Inc.)

> *"Where will mankind be after another 100,000 years? Perhaps flourishing, . . . perhaps deader than a dodo."*

All of these birds are long lived and turnover is slow. Once the population has built up to the supporting capacity of the environment, it is very difficult for a young bird to get established. A long process of maturing is necessary for it to acquire the skills to mate and successfully rear a chick.

One might compare the situation to a stable, closed population of humans which could support only a limited number of professionals, whether surgeons or shoemakers. Youngsters who served a long apprenticeship would be more apt to make the grade than those who tried to rush things. Such a system existed in human societies in simpler times. Even a genius like Benjamin Franklin started as an apprentice printer.

One thus concludes, unlikely though it seems, that condors breed slowly because this is the best that such a long-lived species can do. A pair that started nesting at eight years of age might then have a breeding span of 30 years and rear 15 young. Only two need survive to replace their parents in a population which, like all living species, would have reached a balance point—all that the environment can normally support. The longevity and slow population turnover have helped the condor to survive at low numbers; on the other hand it means that recovery will be painfully slow.

Everything considered, the chances that the California condor can be saved are certainly no better than 50:50, even with captive breeding. Citing this, along with the deterioration of its California habitat and with Los Angeles ever upwind, some have concluded that the funds devoted to the effort might be spent better elsewhere.

Whether one agrees with this conclusion is a matter of philosophy. To the extent possible, no one will quarrel that every species should be saved. Yet human nature being what it is, all of us are more concerned with a condor or a whooping crane than with horseflies. And it is much easier to raise funds for a large, dramatic form of wildlife than for an obscure one. Furthermore, some of the funds and interest will spill over into the conservation movement in general. There is no certainty that the support raised to save condors or bald eagles could be diverted to other species; much of it surely could not.

The truly remarkable growth of interest in wildlife and conservation in recent years has been in large part the result of films about species such as condors, or indignation such as that aroused by the poisoning and shooting of eagles. Questionnaires to the public, to the consternation of commercial interests, reveal that the public wants not less but more concern for land, water, forests, and wildlife. All power to the California condor and those who are trying to save it—by whatever means.

THE AUTHOR

Dean Amadon is the Lamont Curator Emeritus at the American Museum of Natural History.

Greg Beaumont

EVOLUTION OF AN ENCYCLOPEDIA

by John K. Terres

THE TITLE OF THIS ARTICLE is "Evolution of an Encyclopedia." Perhaps it should have been called "How to Wrestle for 21 Years with One Book and Live to See It Published."

It was not 25 years ago (1959), as I have often said, that I began my *Encyclopedia of North American Birds,* but almost 40 years ago. That was the time, while I was still in the Armed Forces in World War II, that I began to write natural history and wildlife conservation articles for popular magazines.

Fortunately for my early writing career, I was stationed in New York City and, in order to research my articles, I became a grubby collector of facts. I practically lived in the New York Public Library and in the library of the American Museum of Natural History where I wrote down in longhand—mostly from scientific periodicals—detailed notes about birds, mammals, insects, reptiles, and amphibians, on large yellow pads or 3″ × 5″ cards that were the beginnings of my reference file. These cards, arranged alphabetically by subject, numbered at least 40,000. They constituted the general nature subjects from which I selected and later prepared a separate card file for the bird encyclopedia. And I never wrote an abstract of a scientific or popular paper without recording the author, title of article, date, and where it was published. This was for future reference if I ever wanted to return for further information. I became a bibliographer who enjoyed his work and during all my years of writing I was, and still am, addicted to the habit.

I am reminded of Dr. Elliott Coues's assessment of a bibliographer. Coues was a brilliant 19th-century American ornithologist and one of the great bibliographers. After preparing three volumes of a bibliography of North American birds, numbering some 15,000 titles, he wrote: "It takes a sort of inspired idiot to be a good bibliographer, and his inspiration is as dangerous a gift as the appetite of the gambler or dipsomaniac—it grows with what it feeds upon, and finally possesses its victim like any other invincible vice."

In a very modest way, I can attest to that statement for even in this quotation, which I remembered only in part, I could not resist hunting it down and at last finding it and recording it exactly.

But my searches in the ornithological literature were not to build a bibliography for its own sake, but to draw information from those more than 4,000 titles I had access to, and to cite them in the encyclopedia as my authorities. They were also for the benefit of those readers who might wish to pursue a subject further.

Many people have asked me how I started the encyclopedia. Did I start with the A's, finish them, and then go on to the B's, the C's, and so on? I started in this way, certainly, and my first article was a short biography titled, ABERT, JAMES WILLIAM, the man for whom Abert's towhee was named; the last article was ZOONOSIS. How-

Below: Budgerigars. Left: Prairie falcon. All photographs are from John K. Terres's "Encyclopedia of North American Birds."

Hans & Judy Beste (Ardea Photographics, Ltd.)

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Black oystercatchers

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Reddish egret: dark and white phases

ever, I never kept to a rule that I must finish one letter before moving to another because later readings would reveal that I had not finished a previous letter at all. In fact, I never knew when a letter was complete until I was nearing the end of the book.

A prime example is DISEASES in which I discovered that I could not do justice to all of the major bird diseases in that one article without making it much too long and tedious. Therefore I wrote as separate articles, AVIAN CHOLERA, AVIAN MALARIA, AVIAN POX, and AVIAN TUBERCULOSIS, after I had completed DISEASES. Thus I contributed substantially to the letter A long after I had thought it completed.

Many large, interesting, and necessary articles were stimulated by one bird family alone—the duck family. They were AVIAN CHOLERA, BACTERIA, BULLA, EELGRASS, EMBERIZID, HETERAKIASIS, NEMATODE, PINION, SALMONELLOSIS, SPECULUM, and WATERFOWL—these after I had spent a month on the research for the duck family.

Often I found it necessary to write a major article before I had approached its alphabetical sequence. For example, I researched and wrote the article, NESTS AND NESTING, before doing EGGS AND EGG-LAYING. Nesting comes before egg-laying in the biological cycle, and it was easier and more natural to cross-reference from nesting to the later egg-laying period. It was in this way, by skipping letters and writing the big, biologically important articles first, that I laid the framework for much of the book, and developed the cross-referencing system as I went along.

Edwin Way Teale was one of my strongest supporters in writing the encyclopedia. I shall never forget my first visit to his home in Connecticut. It was August 27, 1960 and we had a discussion about my initial work on the book. Ed said that he thought it should have a long subtitle, such as one I already had written: *A Compendium of Knowledge about the Physiology of Birds, Their Feathers, Bone Structure, Behavior, Ages, Life Habits, Common and Scientific Names, and a Phonetic Pronunciation for All.* He said this was the sort of thing librarians depended upon as it would give specific information about what is in the book. This was never done and in the editing was discarded as too long and cumbersome—a sort of tail wagging the bird. I think my editors were right, but somehow I still like that long subtitle.

> "Sometimes it was like Alice's journey in Wonderland but with even more marvelous company in the characters of the birds."

Progress was "satisfactory" as I noted on February 28, 1962 when I wrote to Roger Tory Peterson, telling him I had delivered 70,000 words of finished copy to the publisher. I said: "I have overcome the greatest obstacle, in a time-consuming way, of having worked out my formulae for the presentation of the multiplicity of ideas and information that will be in the book. It is an enormous task and might have been too awesome to take on had I known in advance how big a job it was to be. But I am happy in doing it—it is a constant challenge that I delight in. I spend most of my waking hours at it, and when not strictly working, I am thinking, planning, and actually 'writing' my way to its completion, asleep or awake!"

Periodically I delivered to the publisher the original manuscript in batches of 10,000, 20,000, or even 30,000 words. The carbon copy I filed alphabetically in my cloth ring-binder books on my library shelves. These eventually numbered 16 volumes, containing about 50,000 to 60,000 words each. In these I could take out or insert items as the book progressed, retaining what I thought was most important. To keep order, to have the material accessible for reading, correcting, or rewriting was as necessary as the researching and writing of the book itself.

From beginning to end, it was selection that shaped the encyclopedia, always subjecting it to my judgments as to what belonged or did not. Sometimes I went astray in my desire to include everything that interested me

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Steven C. Wilson/ENTHEOS

Least bittern nestlings

about birds—an impossible task especially in one volume. To show how my enthusiasm sometimes carried me away, I occasionally went to great lengths to write on a subject I liked, but later had to discard for a briefer treatment or perhaps to eliminate it altogether. I spent one month researching and writing the history of bird banding in America and Europe. Then I decided not to use it. It was much too long and I felt that I had to limit BANDING to a general discussion that would serve anyone interested in banding work itself. I loved my historical account but brevity had to be served.

What is the encyclopedia process really like? I can assure you it is not the neatly planned journey that one might think. It was like traveling through many great halls and corridors, most of them with windows of light that were the ideas that came gleaming through. Then there were the dark rooms that only after a time opened doors and windows, their unyielding darkness penetrated at last by my complete absorption, day and night, in the book, as one idea led to another.

I am not trying to be dramatic but graphic in showing that the journey was not direct but mostly random and that it was a continuous branching out from that central great hallway that lay always ahead, and leading to an eventual end.

Sometimes I feel the process was like Alice's journey in Wonderland, but with even more marvelous company in the characters of the birds—to see their lives opening up and to feel the satisfaction of getting to know them better as I read and wrote about them. But always there was time looking over my shoulder and the voice that said the job must be finished—hurry, hurry.

Some worry crept in, prompted by conversations with others working in ornithology. Did I know that someone in England was writing a similar book? I did not let this concern me too deeply. After all, I consoled myself, no two people could write a book of this magnitude in the same way.

To illustrate that the work was not pure joy, allow me to quote from a letter I wrote an editor at Knopf on June 6, 1972.

"Dear Best of Friends: After talking with you on the phone this afternoon, I want to emphasize, even though I knew you were kidding me somewhat, that my problem in writing has never been loneliness. It is, especially in the current encyclopedia, a need for more frequent editorial conferences, about technical problems and subject matter in the book, and my need at times for more guidance. I have an absolute horror of doing over and over again some of the material, which I have had to, after reconsideration and editorial advice, which makes the book seem never to end.

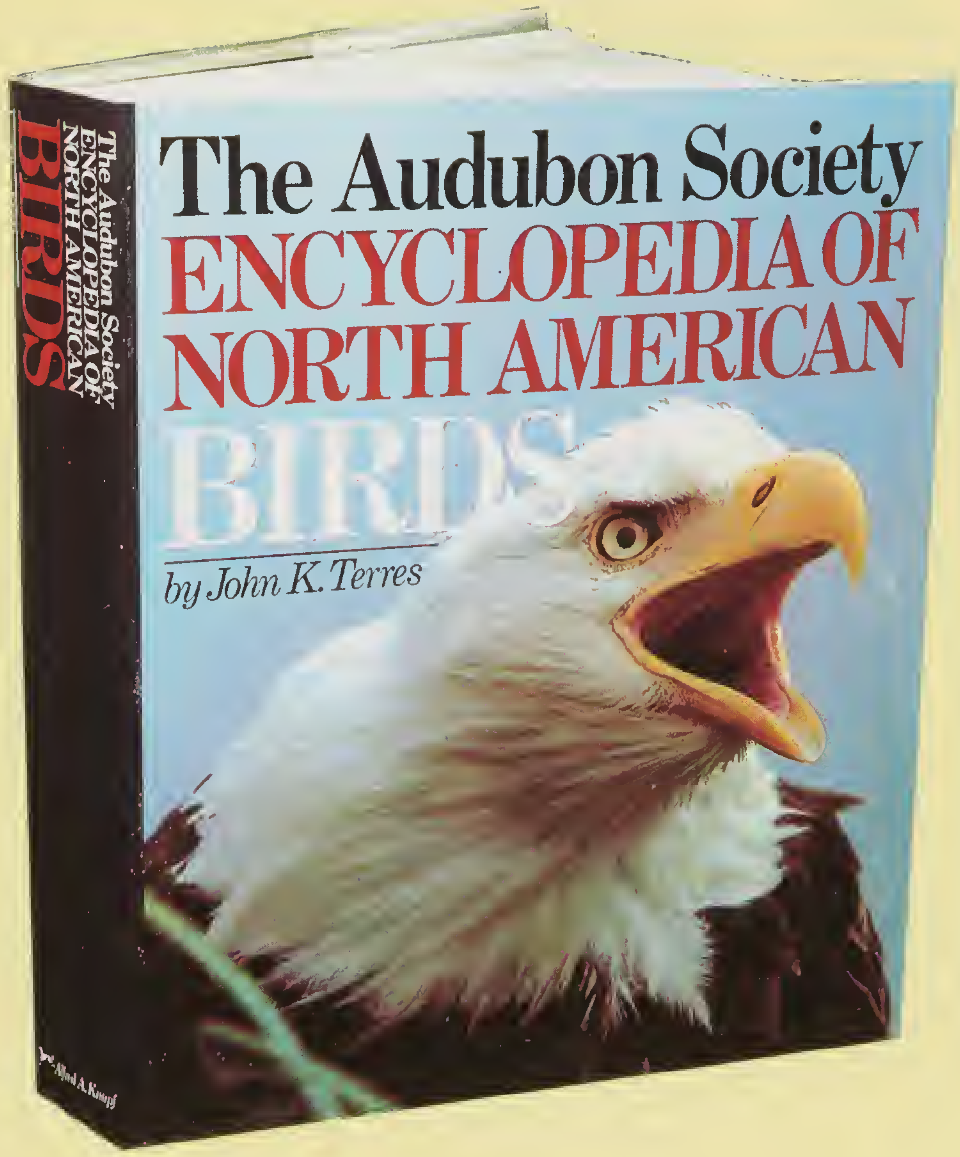
"The frustrations are incredibly trying—in having to revise as I am, the bird biographies, and certain large biological subjects which I wrote some 10 years ago, and am rewriting now because of the need for updating, and even of giving some of the articles a new slant. This has put me in a real emotional bind, at times, as you know, and I have been further frustrated by nagging illnesses—which have not helped because of time lost.

"I must say I enjoyed talking with you on the phone today about birds and nature in general. I especially miss the association with others in my field, but don't want to intrude on the time of others who are just as busy as I am. But those associations do help, what with my virtual incarceration in New York where even the sound of a house finch's voice can be as alluring as a hermit thrush's in its sure effect of taking me elsewhere. . . . "

But the encyclopedia has been fun, and with all the agony and despair that I felt, the vision of a completed work kept me going. Never have I had so great a challenge, and the sheer, even savage joy of the work is still with me. What does one do after keeping steadily at one project for a third of a lifetime? Of course, I have found the answer—it is to start another book! Not so big as the last one, not so long and involved, but in the time required to do it, it will suffice.

Common redpoll

Stephen J. Krasemann/DRK photo



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Islas Encantadas

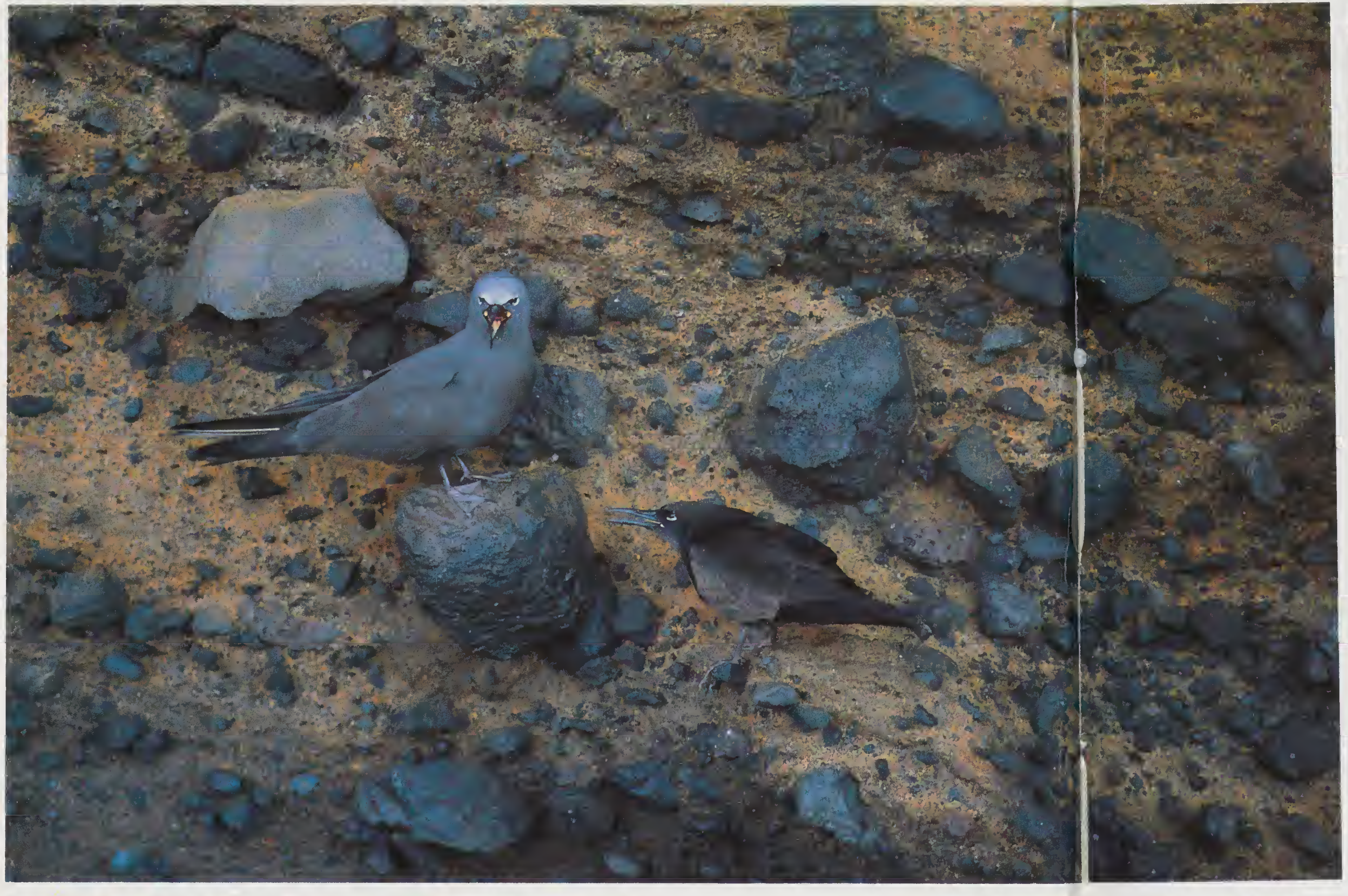
Photographs and text by David O. Johnson

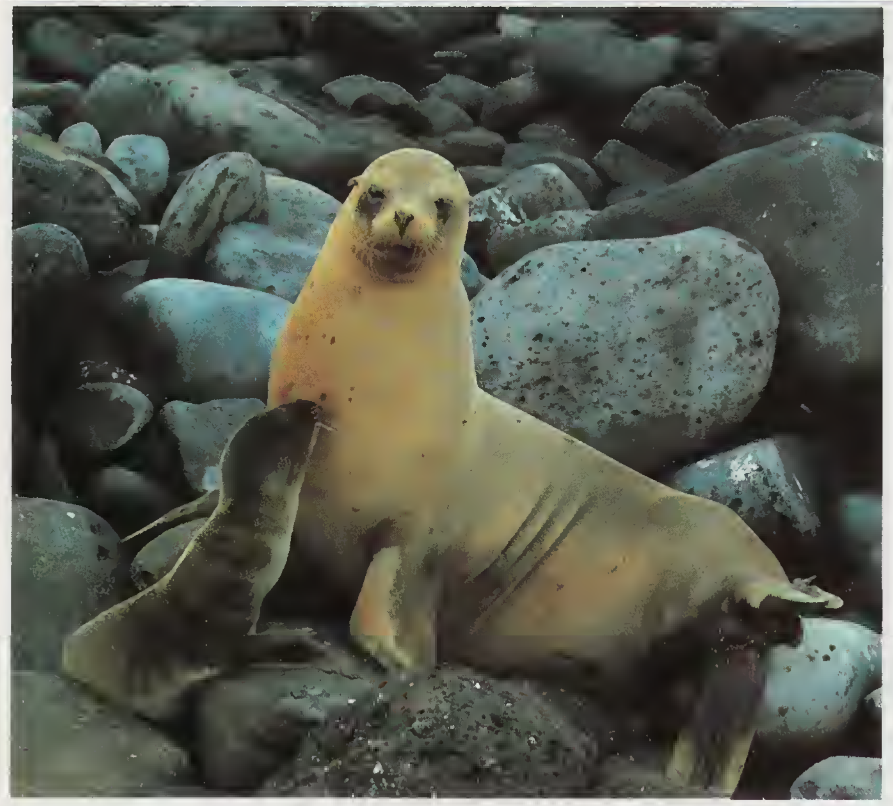
THE GALÁPAGOS ISLANDS, first named *Islas Encantadas* by Spanish navigators, were visited by Herman Melville in 1841. He wrote of his impressions: "Take five-and-twenty heaps of cinders dumped here and there in an outside city lot; imagine some of them magnified into mountains, and the vacant lot the sea; and you will have a fit idea of the general aspect of the Encantadas. . . . In many places the coast is rock-bound, or more properly, clinker-bound; tumbled masses of blackish or greenish stuff like the dross of an iron-furnace, forming dark clefts and caves here and there, into which a ceaseless sea pours a fury of foam; overhanging them with a swirl of grey, haggard mist, amidst which sail screaming flights of unearthly birds heightening the dismal din."

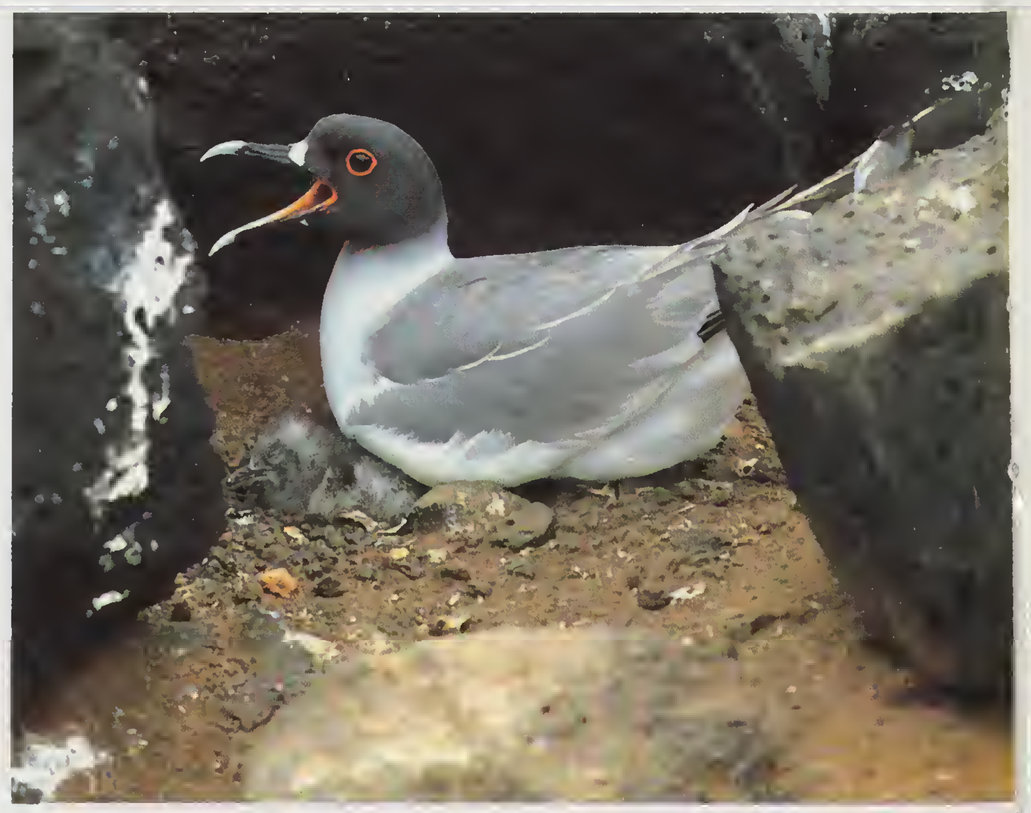
So they were hundreds of thousands of years ago, and so they are today. More than 40 lava-bred tips of submerged mountains form the moonscape islands dotting the Pacific Ocean 600 miles west of Equador. Hot lava still steams to the surface forming new islands and reshaping the old. The bases of the islands lie more than 7,000 feet below the surface of the clear, cold waters—a legacy of the Humboldt Current flowing from the Antarctic and cooling the equatorial Pacific.

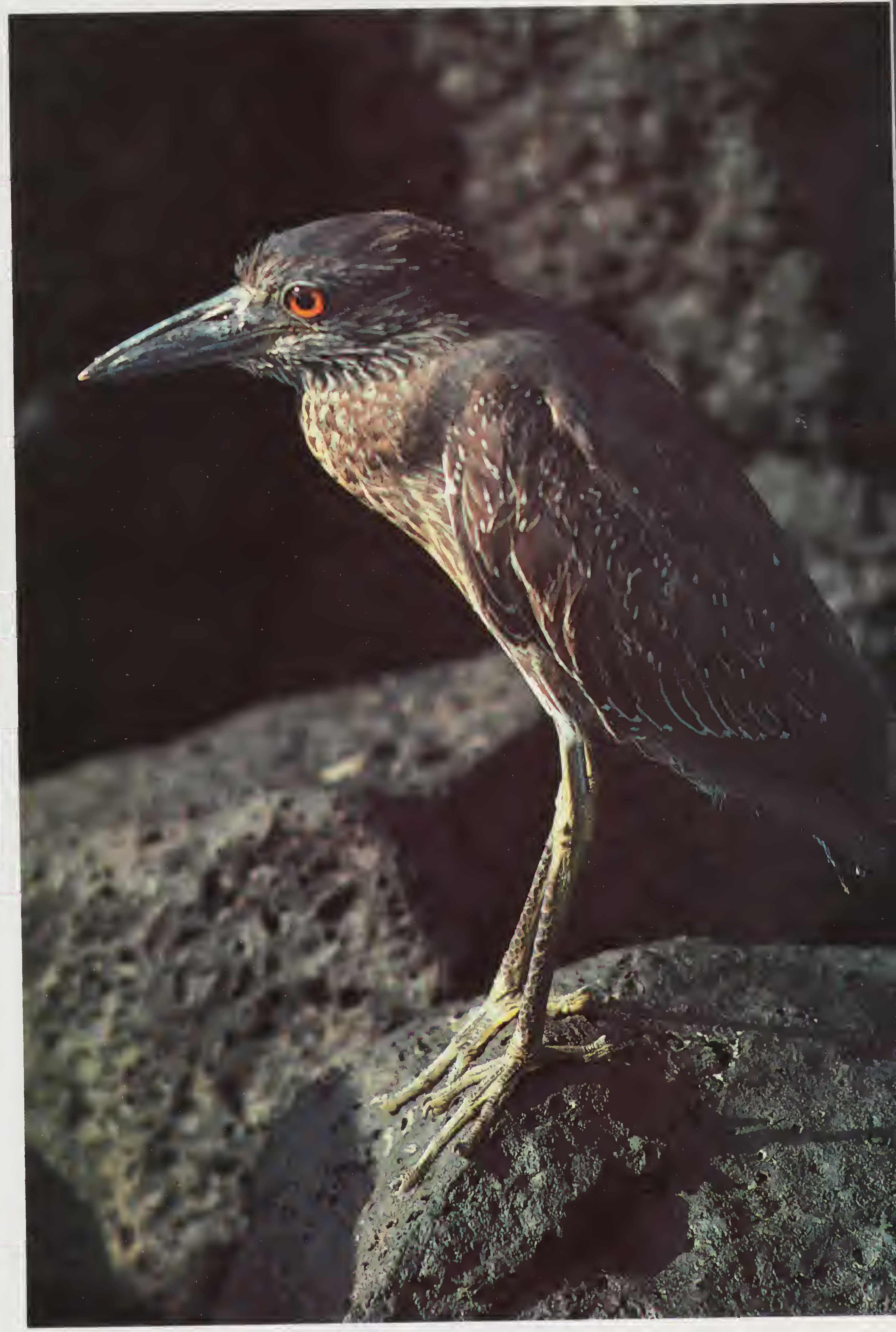
At the water's edge gather seals, penguins, crabs, and marine iguanas. Bright green algae contrasts with the dark rocks and etches the line between the abundant food of the ocean and the fragile inland food chain.

In 1835 Charles Darwin made his historic visit to the Galápagos on the H.M.S. Beagle. He wrote in *Origin of Species* (1859): "Seeing every height crowned with its crater, and the boundaries of most of the lava-streams still distinct, we are led to believe that within a period, geologically recent, the unbroken ocean was here spread out. Hence, both in space and time, we seem to be brought somewhat near to that great fact—that mystery of mysteries—the first appearance of new beings on earth."









Above: Brown noddy, adult and young, on Isabela Island. Right: Immature yellow-crowned night heron on Seymour Island. Left: Swallow-tailed gull and chick, S. Plaza Island. Far left: Fur seal and newborn pup on Hood Island.

TALE OF TWO WOODPECKERS

by John V. Dennis

SURELY BAYARD CHRISTY, writing in A. C. Bent's *Life Histories of North American Woodpeckers*, was describing the ivory-billed woodpecker: "It is a forest dweller; . . . it is alert, furtive (almost) as a bear, rather silent in midsummer . . . and it easily eludes observation." He goes on to describe the huge holes this woodpecker digs in the trunks of trees. Finally, suggesting something a bit uncanny about the bird, he speaks of it as almost a fabulous creature.

Although his description fits today's ivorybill, he actually was writing about the pileated woodpecker. If this seems confusing remember that about 50 years ago the pileated was everything he said it was. It was wary, hard to find and much less common than it is now.

In fact, around 1900, the pileated seemed to be in the same category as the Carolina parakeet and passenger pigeon. As a result of hunting and a seeming inability to adjust to the cutting of timber, this magnificent woodpecker had steadily declined in number. Surprisingly, after it reached a low point around the turn of the century, the pileated began to make a comeback. By 1920, it was not only returning to its former haunts but appearing in second-growth timber—timber that grows after a forest has been cleared. In the words of ornithologist Ludlow Griscom, the pileated woodpecker came back "not so much due to conservation, as to its adaptation to less primeval conditions." By mid-century it had begun to appear in towns, outlying sections of cities, even at bird feeders. The only major requirement seemed to be good numbers of large trees, including a few dead ones for roosting and nesting holes.

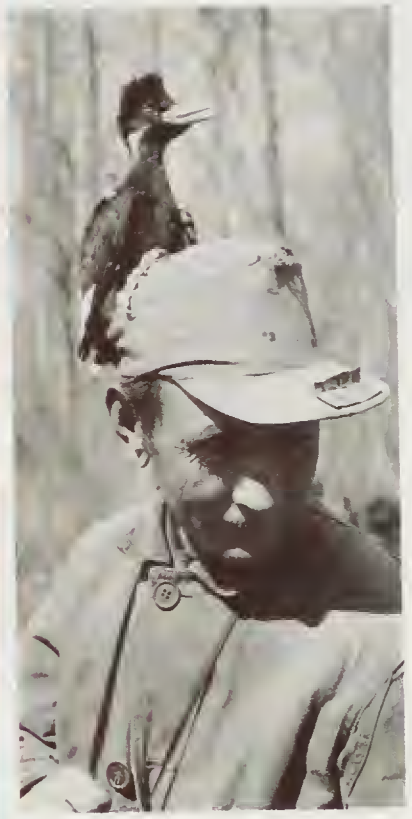
Unlike the pileated, the ivorybill has never shown a tendency to adapt to humans. Its strategy has been to retreat. Once found from southeastern North Carolina and southern Illinois to Florida and eastern Texas, by 1900 the ivorybill survived only in the largest and most remote of the southern swamps. Amid moss-draped cypress trees surrounded by the waters of the swamp, its strange, plaintive calls could still be heard. We do not know whether the ivorybill was always partial to swampland or retired to it because of vanishing forest habitat.

About 1930, Arthur A. Allen, then a Cornell University professor of ornithology, spoke of the ivorybill in Florida as nesting in cypress swamps but doing most of its feeding nearby in young pine trees killed by bark beetles. Perhaps before the arrival of European settlers the ivorybill nested within the safe haven of the swamp but ranged far and wide in search of food. This is only a guess.

As the century wore on, there were fewer and fewer authenticated reports of ivorybill occurrence. Then, during the 1930s, the world was treated to what might have been a final opportunity to learn about this little-known woodpecker. Thanks to the discovery of a small population in the Singer Tract of Louisiana, the first photographs, tape recordings, and extensive life-history studies of this species were procured. James Tanner, then a graduate student at Cornell, played a prominent role in

Right: Young pileated woodpeckers. Far right: Young ivorybill sits atop biologist's hat, 1938.

Laura Riley



©James Tanner from National Audubon Society (Photo Researchers, Inc.)

"The easiest course would be to declare the bird extinct and be done with it."

collecting the information. Ornithologists Arthur Allen, Paul Kellogg, and George Lowery of Louisiana, visited the tract and helped preserve a record of this bird. But by 1948 the 80,000-acre Singer Tract had been cut extensively for lumber and the birds were gone from the area.

At about this time I joined the search for the ivorybill. My first expedition was not to our southern swamps but to the mountains of eastern Cuba. The ornithological community had almost forgotten that the ivorybill is represented in Cuba by a slightly smaller bird, considered a subspecies. Not since the previous century had there been a reliable report of the Cuban subspecies.

Responding to rumors that a few ivorybills were still present in this wild region, birder Davis Crompton of Worcester, Massachusetts and I began our search in April of 1948. We were soon rewarded by finding an active nest tree, where incubation was probably under way. No fewer than three adults were in the vicinity. As an indicator of ivorybill tenacity, the birds inhabited badly cut and burned pinelands. Cuban ornithologists still visit the region and within the past few years have made sightings. But the outlook is not encouraging.

The whereabouts of our North American ivorybill are at present so unclear that it would take a brave person to state anything unequivocally. The few who may have sighted the bird say nothing because they fear that publicity might bring harm to the bird. Others are afraid of ridicule; few serious bird students report seeing an ivorybill these days. But probably as many reports as ever come from novices who continually confuse the pileated woodpecker with the ivorybill. The easiest course would be to declare the bird extinct and be done with it. But the ivorybill has a way of reappearing just when nearly everyone has given up hope.

I still visit our southern swamps on the chance that I'll see an ivorybill. But I must confess that I haven't had any luck since the late 1960s. My first encounter with the North American ivorybill was auditory, not visual. I had joined veteran ivorybill searcher Whitney Eastman of Minneapolis on a trip to the Chipola River in northwestern Florida in the fall of 1950. He and several members of his party had reported seeing a pair of ivorybills after I had left them to return to the University of Florida where I was a student. Returning to the Chipola River on my own, I had the good fortune toward dusk of hearing the distinctive tin-trumpet notes that only the ivorybill can make.

Both photos: John D. Lutz

Typical pileated woodpecker excavations.

> *"The question that puzzles me and others is why the pileated woodpecker thrives under conditions that seem to have doomed the ivorybill."*

In December of 1966, while investigating an ivorybill report from the Big Thicket of Texas, I had my only good look at a North American ivorybill. I say good because I was reasonably close to the bird as it flew before me on its way to a large cypress which stood in the dark waters of a bayou. I could see the wing pattern perfectly but not enough of the bird's head to be sure of the sex. My impression was that the crest was dark, making the bird a female.

I had a second look after it had flown some distance and settled on a stump in an opening in the forest. Seemingly agitated over the presence of a nearby pair of pileated woodpeckers, it had spread its wings in what may have been a gesture of defiance. In February of 1968, I had my last fleeting contact with the bird that I have searched for so often. This time I only heard the voice coming from dense foliage. I did capture the tin-trumpet calls with a tape recorder as I stood at the top of a heavily wooded bluff overlooking Village Creek in the Big Thicket.

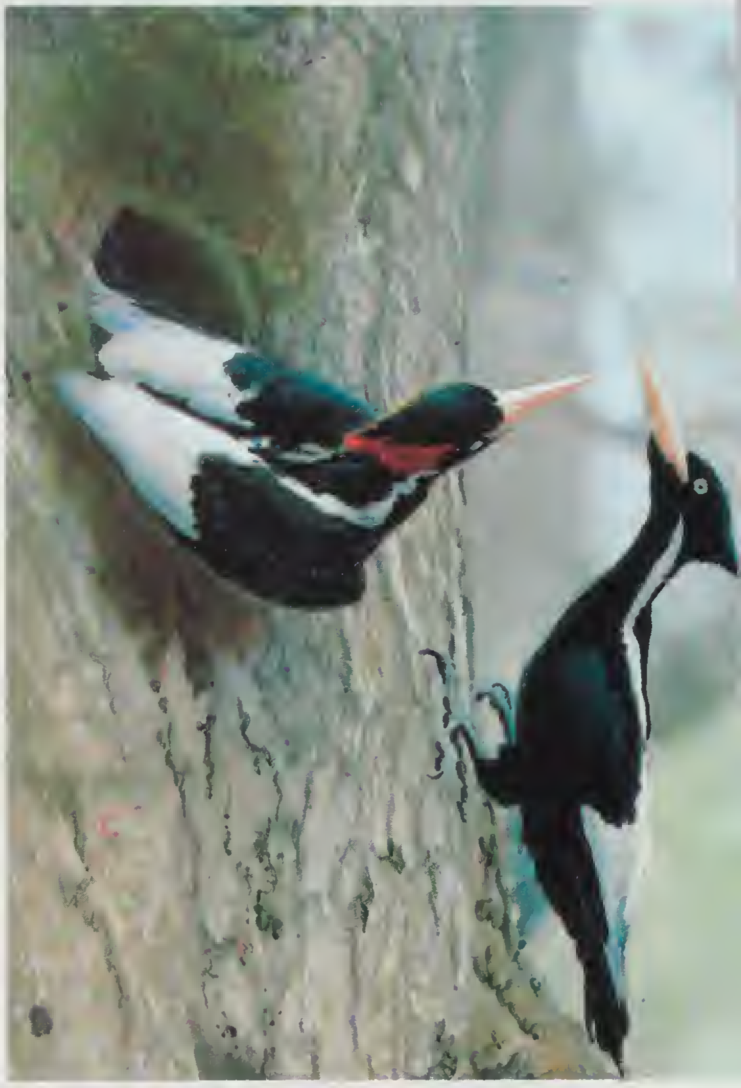
Whatever one may or may not believe about these sightings, there is no escaping the conclusion that the ivorybill is in very precarious straits and may not survive the century.

The question that puzzles me and others is why the pileated woodpecker thrives under conditions that seem to have doomed the ivorybill. Both are much larger than other North American woodpeckers. The pileated's length ranges between 16 and 19½ inches, the larger birds belonging to the northern race; the ivorybill has a length of about 20 inches. Both species are conspicuously crested. The male and female pileated have striking red crests, while in the ivorybill the male has a red crest and the female a black crest. Both woodpeckers are otherwise clothed in black and white—more white in the ivorybill, less in the pileated. In spite of these resemblances, the two species are not closely related; each belongs to a different genus.

An important difference between the two species pertains to the structure and function of their bills. The bill of the ivorybill is not only larger and more powerful than that of the pileated but the tip is blunt, like a chisel. The ivorybill uses its bill very effectively to remove the bark from trunks and branches of recently killed trees. Here it finds the large and juicy larvae of wood-boring beetles. For a while it has a monopoly on this food. No other woodpecker can pry off the bark until it has become loosened with age. The ivorybill's whole evolution seems to have centered around this advantage. So long as there were plenty of dead

Both photos: Arthur A. Allen Papers, Cornell University Libraries, Manuscripts and Archives

Dr. Arthur A. Allen watches ivory-billed woodpecker nest in Louisiana's Singer Tract.



Pair of adult ivory-billed woodpeckers.

and dying trees, the ivorybill had the food it needed.

The pileated woodpecker has a smaller, more pointed bill that is better adapted for more generalized types of digging and food finding. It sometimes competes with the ivorybill when it uses its bill to forage for beetles that live under bark. But more than half of its animal food consists of ants, often procured from rotting logs on the forest floor. And during certain seasons the pileated feeds heavily upon grapes and other wild fruits and berries. The ivorybill takes some vegetable food but seems less versatile in its feeding habits. With changing habitat conditions, it is usually the generalized feeder that wins out over the specialist. But other factors also need to be considered.

Looking back to the writings of early naturalists, we find Mark Catesby describing the uses that the Indians made of the ivorybill's striking ivory-colored bill. In 1731 he states that the Canadian Indians "made Coronets of 'em for their Princes and great warriors, by fixing them round a Wreath, with their points outward." Catesby goes on to say that the northern Indians traded with more southern tribes, paying as much as two or three buckskins per bill. Both Alexander Wilson and John James Audubon commented upon the use the Indians made of the ivorybill's bill and plumage. The early settlers also used parts of the ivorybill for decoration.

By the time the ivorybill became too rare for commercial exploitation, it had a new enemy. This was the museum collector, a breed that toward the end of the last century pursued the ivorybill to its remotest retreats. The story might have ended here had it not been for a new conservation ethic that swept the country. Birds and other wildlife on the verge of extinction had to be saved. Although the shooting ceased, it was apparently too late for the ivorybill. Unlike the pileated woodpecker, it did not recover but lingered in limbo.

Allen and Kellogg, writing in a 1937 issue of *The Auk,* offered a hypothesis that seemed to explain the ivorybill's inability to respond to more favorable conditions. They suggested that, with its increasing scarcity, inbreeding could have led to weak young and infertile eggs. But Tanner's studies in the Singer Tract did not lend support to this contention. He found that the nesting success of the Singer Tract ivorybills was approximately the same as that of the pileated woodpecker. Something else was dooming the ivorybill.

For this something else, I think we must return to the ivorybill's highly adapted bill. It was the bill that captivated the Indians and early settlers, causing so much slaughter. It was the bill that made the ivorybill a specialist, feeding upon beetle larvae that existed in adequate numbers only where very large tracts of timber existed. Under primitive conditions the ivorybill had an advantage because of its bill but as the timber was felled and the forests disappeared, the advantage was lost.

Others, however, have alternative explanations for the demise of the ivorybill. But whatever the reason, the fact remains that the ivorybill hangs on by only a slender thread.

FURTHER READING

Dennis, John V. "The Ivory-billed Woodpecker." *Aviculture Magazine* 85 (2). 1979.

Tanner, J. T. "The Ivory-billed Woodpecker." National Audubon Society, New York. 1942.

THE AUTHOR

John Dennis is author of *A Complete Guide to Bird Feeding* and *Beyond the Bird Feeder.*

Russ Kinne (Photo Researchers, Inc.)

Birding on the Yucatán Peninsula

by Ernest P. Edwards

Charles R. Smith

Ernest P. "Buck" Edwards
Left: Blue-crowned motmot

MAKING OUR APPROACH to Cozumel Island on a jetliner from Miami, our Cornell birding tour group looked down upon ever-changing shades of blue and green. The shallow waters of the Caribbean Sea washed the coral shores of this island just off the east coast of Quintana Roo in Mexico. Most participants on this tour had attended the first Cornell tropical field seminar which I had taught also. The Yucatán Peninsula had been judged an ideal second tropical destination. Birds would be easy to see in the patchwork of fields, gardens, and low woodlands, and the Mayan ruins would form an ideal counterpoint to the exotic birds.

As the plane neared the runway, my thoughts turned back 25 years to the time I first saw Cozumel Island—unspoiled and teeming with wildlife. On that visit, after days of driving, a long bus ride, and a 28-hour train trip to reach the Yucatán Peninsula, I had flown from Mérida to Cozumel on a World War II-vintage transport plane and landed on a dirt runway. We managed to find a car and driver to take us into Cozumel. There we searched out the owner of the small general store, the largest store in town, and picked up the key to a beach-front cottage. For our meals we walked to the other side of town, a six-block stroll, to the open-air restaurant comprising three small tables in the backyard of another cottage.

To see the ruddy ground-dove, Caribbean elaenia, Cozumel wren, and bananaquit, which had lured us to Cozumel, we had to walk only a few hundred feet along a trail which led through pastures, weedy fields, thickets, and patches of scrubby woodland. We found a flock of Vaux's swifts roosting in an old cistern. A car took us on a dirt road through thorny woodland to a beautiful pool called Laguna Chancanab. We saw several striped-headed tanagers, an Antillean species not known anywhere on the mainland of Mexico. Surprisingly, because it was only the first week in August, we saw migrating prothonotary warblers and Kentucky warblers not many days from their summer homes somewhere in the States. Tropical fish swam in and out of the blue waters of Chancanab and through the natural underground aqueduct which connected the coral-rimmed pool to the sea.

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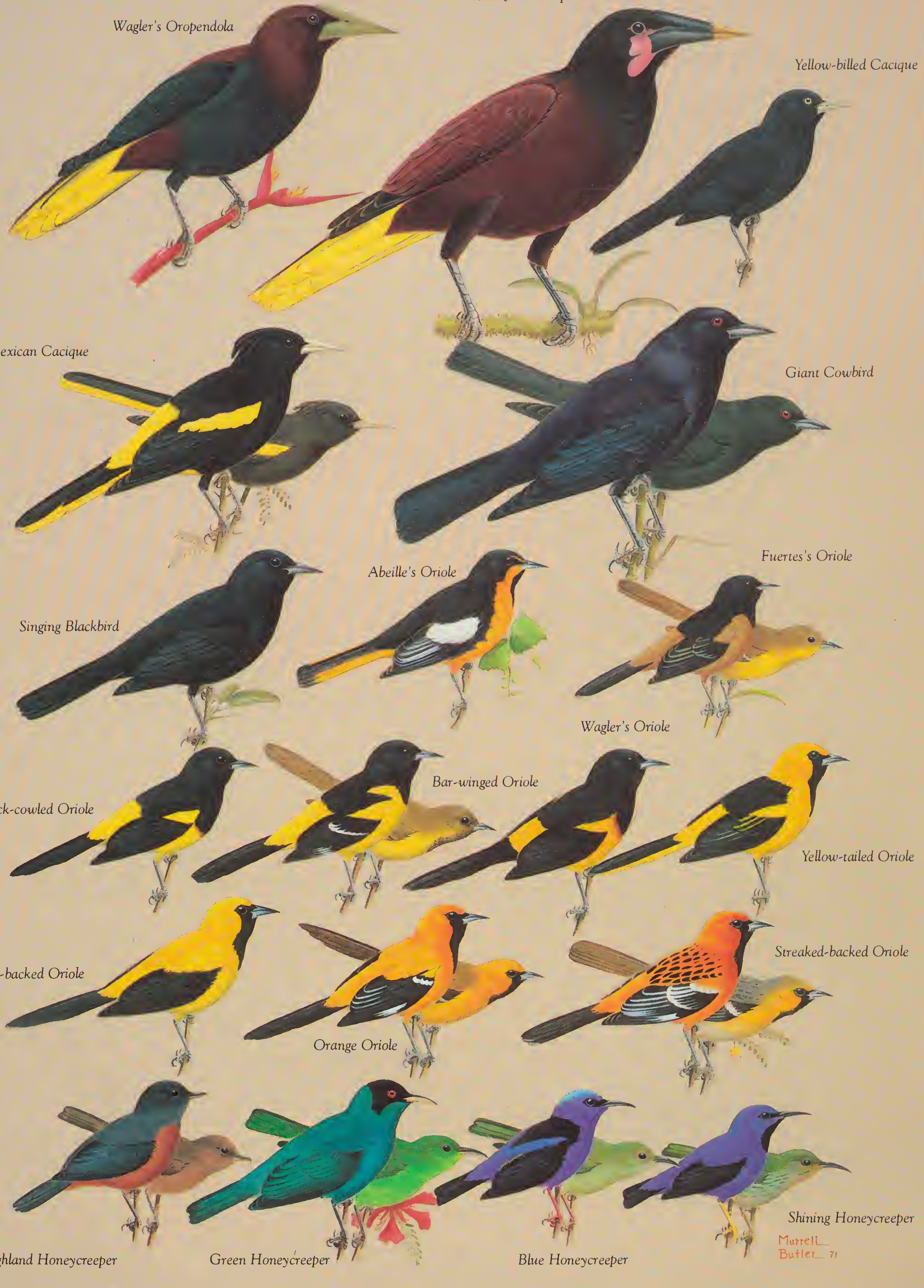
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Bar-winged Oriole
Black-cowled Oriole
Yellow-tailed Oriole
Streaked-backed Oriole
Yellow-backed Oriole
Orange Oriole
Shining Honeycreeper
Murrell Butler 71
Highland Honeycreeper
Green Honeycreeper
Blue Honeycreeper

Now, 25 years later, the sight of the hotel-lined boulevard, and the sprawling resort town where once stood only a village, gave rise to some concern. We walked in a crowd of tourists through the airport terminal, past souvenir shops, to the baggage-claim section and tried to find our suitcases and the proper van to our hotel. We drove past hotels and resort homes, through blocks of houses, shops and restaurants, finally reaching the main plaza where our old all-purpose store once stood. We continued southward through business and residential areas which once had been open countryside.

Still on a paved road we turned right and entered the grounds of the beachfront Hotel El Presidente. Great-tailed grackles flew noisily among the flowering trees in the parking lot, and hummingbirds—Prevost's mangos and cinnamon hummingbirds—searched for nectar in the blossoms. Tropical kingbirds perched on the TV antenna and on the lawn sprinklers, and yellow-faced grassquits flew up from the short grass near the tennis court. Despite this reassuring sight I wondered if the mushrooming resort could accommodate swimmers, scuba divers, sunbathers, and beachcombers, yet provide access to a great variety of unusual birds.

Our first field trip dispelled any doubts. Within a hundred feet of the hotel we found a little-used side road which proved to be a showcase for great numbers of tropical-island birds.

We had hardly left the hotel parking lot when we heard the mournful descending call of the streaked attila, a species I had seldom seen or heard and then only in luxuriant forests of giant trees. One individual even flew out to perch on a utility pole. Near an old shed beside a weedy field a Cozumel wren sang its bubbling song, and Yucatán woodpeckers and Wied's flycatchers showed a proprietary interest in a recently excavated nesting cavity in a dead tree. There, and in the fields just beyond the hotel's yacht basin, we saw migrating or wintering warblers and finches, including black-throated green, blue-winged, Cape May, magnolia, and palm warblers.

Still walking northward we rounded a curve in the road and lost the hotel from view behind the bordering low woodland. Here we found more specialties of Cozumel Island: the Caribbean elaenia, another Antillean species not found on mainland Mexico; the Cozumel thrasher, and the Cozumel vireo. Peppershrikes and Yucatán vireos were there as well, and the more familiar blue-gray gnatcatcher.

Pairs of black catbirds hopped on the asphalt surface of the road as far as we could see. Most exciting of all were the small flocks of parrots that swirled overhead, filling the air with their raucous cries. They were mostly white-fronted parrots, both sexes brightly colored about the head. We were able to prove the presence of a few Yucatán parrots by picking out an occasional dull-headed female. As co-leader of the tour group I was delighted at the auspicious beginning of the trip, and shared in the excitement even as I anticipated other great birding experiences.

Robert Lee (Photo Researchers, Inc.)

Hooded oriole. Left: Plate from Edwards's book, "A Field Guide to the Birds of Mexico" (Ernest P. Edwards, Sweet Briar, Virginia).

As we returned along the side road, with the hotel only a few hundred yards ahead, another experience awaited us. A group of rose-throated tanagers suddenly appeared among the scattered shrubs, along with some migrating warblers. As we watched the birds in full view and good light, we marveled at the soft grays and rosy, pinkish reds of this rare specialty of the area, and were struck by the realization that the colors were more reminiscent of male pyrrhuloxia than of other Mexican and North American tanagers.

Another exceptional experience occurred on our last morning in Cozumel. This time we went only as far as the small combination field, marsh, woodland border, and overgrown weedpatch surrounding some tumbledown buildings 150 yards from the hotel. There, as we stood in a moist, marshy area and scanned a nearby field, a movement near our feet prompted us to look down to see a tiny but full-grown red rail. It looked around in a perplexed manner, then calmly but quickly and without making a sound, moved into some cattails and disappeared. Some of us had heard the whinnying calls of this species in other parts of Mexico and Central America, but none had seen the bird, and none, as far as I know, has seen it since.

With the memory of the red rail, which may have been a new record for the island, the colorful tanagers, and unusual parrots and pigeons, we boarded the bus to the airport and flew to Mérida.

Flying low over the waters separating Cozumel Island from the mainland, I observed the terrain and the vegetation and reviewed the striking differences between the Yucatán Peninsula and the rest of Mexico. While most of Mexico is mountainous, or at least 3,500 feet above sea level, the Yucatán Peninsula is virtually flat and is almost nowhere more than 100 feet above sea level. The vegetation of its western portion is scrubby, dense, tangled, deciduous woodland. Farther east there are larger trees in a more luxuriant growth approaching the aspect of tropical rain forest. Although much original vegetation has been cleared, one can still find large tracts of native woodland or forest, particularly near the popular archaeological sites where good accommodations are available and native birds accessible.

Summer weather is hot, and there are frequent rains, often fast-moving storms of wind, driving rain, thunder and lightning. At this time vegetation is green and luxuriant even in western portions of the peninsula. Butterflies are incredibly abundant. Birds are active and conspicuous, especially in early morning and immediately after a rain.

As winter approaches, most plants lose their leaves, particularly in the west, and the woodlands appear dry and open. Although winters are warm and dry, occasional chilly, windy, rainy weather modifies the idyllic climate. Nesting activities and bird song largely cease, but with the influx of migratory birds in autumn, bird activity does not subside overall.

On March 15 our tour group rode 50 miles southward from Mérida on a chartered bus—destination Uxmal. We rode through small Mayan villages, past

Albert Kuhnigk (Valan Photos)

Cinnamon hummingbird

F. Gohier (Photo Researchers, Inc.)

Ferruginous pygmy-owl

former haciendas, some tumbling down, others still producing and processing henequen into sturdy rope. Ruddy ground-doves, common ground-doves, and great-tailed grackles frequented the roadside and farmyards and even the village plazas and vacant lots. Tropical mockingbirds perched on the telephone wires and trees along the way.

When we reached Uxmal we checked into a pleasant hotel called Hacienda Uxmal which was only a few hundred yards from the archaeological site. There was no real village here. The hotel was surrounded by gardens which in turn were adjacent to extensive patches of woodland that covered the countryside. Thus the hotel grounds were a haven for resident and migratory birds, especially during the dry season. From our rooms we could hear the songs or calls of the ruddy ground-dove, pauraque (at night), turquoise-browed motmot, and clay-colored robin. Social flycatchers, great kiskadees and great-tailed grackles frequented the palm trees around the swimming pool. Once, cave swallows came by the dozens from the old Mayan city to skim swiftly over the pool and to dip their bills into the water for a drink.

At about six o'clock the next morning we went walking past the parking lot and archaeological site. We turned right on a paved road which led to the old city. Here there was less traffic although we were occasionally surprised by buses or cars coming in to park in a random manner as we watched orange orioles, boat-billed flycatchers, and turquoise-browed motmots. The weedy patches, low woodland borders, and telephone wires were alive with birds. Migrating finches were in the weed patches—indigo bunting, painted bunting, and blue grosbeak, and a resident finch, the blue-black grassquit. Many males were molting the drab winter feathers and gaining their colorful breeding plumage. Blue-gray gnatcatchers hopped about in the leafless trees. White-winged doves called from farther back in the woodland.

Leaving the parking area, we walked along a dirt road and soon were on a narrow track through low, still leafless, woodland. I began to imitate the persistently repeated notes of the ferruginous pygmy-owl, which we knew occurred here. Promptly a cinnamon hummingbird darted into view, and soon a pair of blue-gray gnatcatchers and one of the *Myiarchus* flycatchers joined the group of small birds intent on mobbing the little owl. Before long a real pygmy-owl answered from the woodland, then flew in and perched nearby. Then another pygmy-owl came by and, although they were anything but conspicuous, we were able to study their fierce yellow eyes and soft brownish-red plumage. As the real owls began calling they were even more effective than I in attracting hummingbirds, gnatcatchers, a mangrove vireo, a white-eyed vireo, and other small birds which had remained hidden.

Before we turned back we saw one, two, then more turquoise-browed motmots. For many minutes we were surrounded by a dozen of these striking tropical birds, moving about in an agitated manner, often less than 30 feet away. The long, racket-tipped tail switched back and forth like an erratic and impulsive pendulum, a behavioral feature which has earned the motmot the name of "clock bird."

The next day we drove to Mérida and boarded the plane back to Miami. As we flew out over the Caribbean Sea, the shallow near-shore waters seemed to reflect all the turquoise, cobalt and aquamarine we had seen on the turquoise-browed motmot the day before. Our Yucatán experience had been at least as rewarding and enjoyable as the one of 25 years earlier and we were reassured that this would likely be true for years to come.

FURTHER READING

Edwards, Ernest. *Finding Birds in Mexico.* 1968. Supplement, 1976. Sweet Briar, Virginia.

THE AUTHOR

Ernest Edwards is the Duberg Professor of Ecology at Sweet Briar College, Virginia.

NEWS & NOTES

A western reef heron was seen on Nantucket Island, Massachusetts on April 26, 1983, over 4,000 miles from its coastal African home. It was the first time this species had been spotted in the United States. At first it was misidentified as a little blue heron with aberrant plumage, but the bird's bright yellow feet gave local birders the clue that they were not watching an ordinary heron. After studying pictures taken by a Philadelphia Academy of Natural Science photographer, Academy staffer Robert Ridgely identified it as a western reef heron. Two other staffers, Alec Forbes-Watson and Michael Kleinbaum, confirmed the identification in the field. After checking the International Species Inventory to be certain that the bird was not registered as a captive species in the U.S., they were satisfied that it was wild. If the species were listed, then the bird might have been an escaped captive. When the sighting was made public hundreds of birders flocked to the scene. The heron remained on Nantucket throughout the summer.

The Peregrine Fund has announced its plans to open the World Center for Birds of Prey. The aim of the center will be to identify and bolster populations of endangered or threatened hawks, falcons, eagles, and owls around the world. Research by raptor specialists may result in a frozen semen bank which will guard against future extinctions. In addition the center is hoping to start cooperative ventures with other countries to save birds in their native habitat. The center will be located on 280 acres in Boise, Idaho.

Although the center is still in the planning stages, Peregrine Fund specialists are studying orange-breasted falcons in Guatemala, aplomado falcons in Mexico, Mauritius kestrels in Mauritius, and elf owls in Arizona. The Philippine eagle is slated to receive help as soon as the political turmoil in the Philippines cools. Only 200 to 300 remain and of four pairs under observation in the wild none has fledged young in several years. Philippine eagles in captivity are not reproducing. A program to artificially inseminate, incubate, and hatch wild eggs, and properly feed and raise the young eagles, will begin once the safety of the researchers can be assured.

On the home front The Peregrine Fund produced 260 peregrines in its facilities during the 1983 breeding season.

Correction: The photograph of a peregrine falcon on page 27 of the autumn 1983 *Quarterly* should have been credited to James Weaver.

Dear Member:

Bird populations are constantly changing—some species increase in number and expand their ranges while others decrease. When I was growing up in Cambridge, Massachusetts, seeing a mockingbird, cardinal, or tufted titmouse was cause for excitement. All three are now common residents. In contrast, the bluebirds which used to be so plentiful at our place in Hancock, New Hampshire, are now rare. These casual observations make us wonder why these changes have occurred. Have they resulted from changes in climate? In certain cases: some researchers feel that warmer winters have aided the cardinal's and titmouse's northern movement. Have changes resulted from modern lumbering techniques? Sometimes, yes. In many areas bluebirds are suffering because of the removal of dead trees where bluebirds nest (although this isn't true in Hancock where my father maintains nesting boxes for bluebirds). Or do the changes in bird populations result from modification of wintering areas—from pesticide applications which destroy food supplies or from destruction of winter habitat?

This last idea is a sobering possibility. Many birds that breed in the United States spend their winters in South and Central America, where habitat destruction is proceeding at an astonishing rate, and where dangerous pesticides, some of which are banned in this country, are used in tremendous quantities.

We have no way of predicting the effects of widespread habitat destruction in the tropics. Populations of birds that prefer disturbed habitat could increase. But it is likely that overall the effects could result in severe declines. Already some songbirds, such as the Kentucky warbler, seem to be returning each year to their breeding grounds in reduced numbers.

Yet all is not lost. As Ernest Edwards writes in his article about the Yucatán, birds of many species seem to be faring well in that area of Mexico. Still, it seems that we should approach the future with cautious optimism and a good system for monitoring bird populations. Only if we have an accurate measure of how bird populations are changing can we find the reasons why. And until we can identify the reasons, impassioned pleas to save tropical forests or to stop the spraying cannot be nearly as effective as if we had hard facts from which to argue.

CHARLES WALCOTT, *Executive Director*

Biomedical Communications: Cornell Vet College

The first auction of art for ARC was held at the Laboratory of Ornithology last October. ARC is the Avian Rehabilitation Center, a cooperative effort of the Laboratory of Ornithology and the Avian Clinic of the New York State College of Veterinary Medicine. ARC was established to care for sick and injured wild birds and to return them to the wild. The bird art was donated by local and nationally known artists as well as by art collectors. Despite heavy rain a crowd of eager bidders turned out and by the end of the day over $2,600 had been raised.

The goal of ARC is to provide the birds with the best possible care during convalescence. The money raised by the auction will buy materials for six flight cages complete with perches and baths. Equipment such as weighing scales, heat lamp, special gloves for handling raptors, and first-aid supplies will be purchased.

ARC's volunteer staff have returned a healthy 60 percent of their charges to the wild.

The sixth edition of the *A.O.U. Check-list of North American Birds* is now available. This volume will remain the standard taxonomic listing of birds for many years. The Crow's Nest Bookshop at the Laboratory has a limited quantity of the *Check-list* available for $35.00 plus $2.00 postage and handling (no member discounts). New York State residents must add 7 percent tax. Send a check or money order to The Crow's Nest Bookshop, Laboratory of Ornithology, Cornell University, Sapsucker Woods, Ithaca, New York 14850.

RESEARCH & REVIEW

Richard E. Bonney, Jr.

Quacker Boxes

Scientific theories are ideas that offer tentative explanations for the way the world works. They are based on facts as the facts are understood at the time the theories are proposed. As scientists discover new evidence, theories are modified or even discarded. For example, astronomers once believed that the sun revolved around the earth. Not until Copernicus presented evidence that the planets revolve around the sun was the original theory replaced by the new one. Similarly, Timothy Johnston and Gilbert Gottlieb of the North Carolina Division of Mental Health recently have uncovered new facts leading to their reevaluation of the role of imprinting in nature.

Imprinting is a biological phenomenon whereby precocial birds—birds that leave their nest soon after hatching—form an attachment to the first object they see upon emerging from the egg. Biologists have long theorized that imprinting is the means by which these birds learn to recognize other members of their own species, especially their mother. Most studies, however, have tested this theory by imprinting birds on non-biological objects such as toys or boxes. When Johnston and Gottlieb tried to imprint mallard ducklings on stuffed models of various species of waterfowl, they were only partly successful ("Development of visual species identification in ducklings: what is the role of imprinting?" *Animal Behavior*, vol. 29, pp. 1082–1099). They concluded that the traditional explanation of the role of imprinting may be erroneous, and speculated that in the wild, newborn ducklings recognize their mother and form attachments not through sight but through sound.

Johnston and Gottlieb have examined this idea through further testing ("Visual preferences of imprinted ducklings are altered by the maternal call," *Journal of Comparative and Physiological Psychology*, vol. 95, pp. 663–675). The goal of this study was to discover what was more important in getting mallard ducklings to follow a model on which they had been imprinted—the sight of the model or the sound of the maternal call.

In their first experiment, 50 one-day-old ducklings were imprinted on a stuffed female mallard. Then, the ducklings were divided into two groups. Those in the first group were given a choice of following the familiar mallard model or an unfamiliar red box. Almost all the ducklings followed the familiar model.

Ducklings in the second group were given a choice between following the familiar model or a red box emitting a mallard maternal call. All the ducklings followed the calling red box. Apparently the sound of the maternal call overrode the fact that the ducklings had been visually imprinted.

Was the maternal call necessary to elicit the following response by the ducklings or would any sound work? The researchers designed a second experiment to find out. Thirty imprinted ducklings were given a choice between following either the familiar mallard model emitting electronic monotones or the unfamiliar red box emitting the maternal call. Nearly 80 percent of the ducklings followed the box. Apparently they preferred the maternal call to the non-biological tone as well as to the familiar, stuffed model.

The role of the maternal call has not been ignored in earlier studies; some researchers have thought that the call guides precocial birds to the mother so that visual imprinting can occur. But the role the call plays *after* imprinting has occurred has been largely overlooked. Johnston and Gottlieb feel that the call is responsible for maintaining the mother-offspring relationship and that the role of visual contact is secondary.

Beyond Field Guides

Many birders want to know more about birds than they can find in field guides. Where do birds live? What do they eat? Who are their enemies? Recently, several books have been published to help fill the need for this type of information. One of the newest is *America's Favorite Backyard Birds* by Kit and George Harrison (Simon and Schuster, New York. 1983. $15.95, cloth, 288 pages).

This book discusses the lives of 10 birds common throughout North America, including the American robin, black-capped chickadee, and blue jay. There is one chapter for each bird. The text is easy reading, and includes technical information gleaned from ornithological literature as well as information derived from the authors' own observations. The Harrisons describe plumage, song types, food habits and habitat preferences of each bird. They discuss nesting behavior and care and feeding of young in detail, and include numerous facts about interesting and unusual behavior. Each bird is shown in color, and an appendix lists plants and trees used for food, cover, and nesting by the 10 birds.

Writing about animals in an objective yet interesting way is not easy, but the Harrisons make an admirable attempt. In doing so, some anthropomorphism does emerge. For example, mourning doves are said to have "soaring love" while the American goldfinch is described as a "patient sitter" and "friendly to all." This is not a large problem, however. A bigger problem is the muddy appearance of most of the black-and-white photographs. The 10 color photographs are clear.

Overall this is a fine book, providing insight into the lives of common birds. It should appeal to adult and young readers alike.

An earlier book, also written to answer questions about the lives of individual birds, is Donald Stokes's *A Guide to the Behavior of Common Birds* (Little, Brown, and Company, Boston/Toronto. 1979. $9.95, cloth, 336 pages). Like the Harrison book it devotes a separate chapter to each bird, 25 in all. Unlike the Harrison book, this one is devoted to descriptions of social behavior, that is, interactions among birds, such as territoriality, courtship, breeding and flocking. In his excellent introductory section, "Behavior Watching," Stokes explains that for most birds far more mysteries exist than answers concerning behavior. He writes: "One of the main purposes of this guide is to encourage everybody to participate in helping to discover the behavior of our common birds. If just a fraction of the energy that now goes into bird-watching were to go into behavior-watching, within a very short time our knowledge about the behavior of our common birds would be greatly increased."

This book is written more tersely than the Harrisons' and is probably best suited for careful observers who watch individual or small groups of birds for long periods of time. Each chapter is divided into three parts. The first is a graphic behavior calendar that shows the different behaviors that occur each month. The second is a display guide which, with line drawings and written descriptions, explains the visual and auditory displays used by the birds. Finally, Stokes describes several behaviors in detail:

those associated with territory, courtship, nest-building, breeding, plumage, and seasonal movement.

This well-written book is presently the best means of answering the question "what's that bird doing?" While not easy reading like the Harrisons' book, it rapidly becomes absorbing once you realize you've observed some of the behaviors Stokes describes. This is an excellent book for parents who want to help their children observe the natural world more closely.

Information Parasitism

Information parasitism sounds like a horrible affliction or a by-product of the computer age. Actually, G. L. Nuechterlein of the University of Minnesota's Bell Museum of Natural History has adopted this term to describe a relationship between western grebes and Forster's terns ("'Information parasitism' in mixed colonies of western grebes and Forster's terns," *Animal Behavior,* vol. 29, pp. 985–989).

Nuechterlein studied western grebe nesting colonies on the Delta Marsh, Lake Manitoba, Canada, for seven breeding seasons. He discovered that most of the colonies included nesting Forster's terns. When he approached these mixed colonies, the terns sounded alarm calls that warned not only other terns but also the grebes; the grebes immediately jumped off their nests and swam for open water, even those birds on nests concealed in clumps of vegetation.

Nuechterlein wanted to test his discovery with tape-recorded tern calls. The test required him to approach the colonies undetected, so he built a small floating blind and disguised it as a muskrat house by covering it with reeds. Muskrat houses are common nesting and resting sites for Forster's terns on the Delta Marsh, and the terns adapted readily to the blind. In fact, terns often landed on the blind and defended it for hours against other terns.

From the concealment of the blind, Nuechterlein broadcast tape-recorded tern calls. When he played recordings of non-warning calls only 3 of 26 experimental grebes left their nest or adopted an alarm posture; when he played recordings of tern-warning calls, 21 of the 26 grebes showed an alarm response.

Nuechterlein suggests that the grebes, which are poor fliers and usually dive to escape danger, establish their nests near tern colonies so they can use the terns as aerial sentinels. He categorizes this relationship as information parasitism because there is no apparent reciprocal exchange of information. He points out, however, that the terns are not harmed by the association. One researcher has suggested that alarm callers may benefit by warning nearby non-relatives; if all potential prey in an area are alert to impending danger, the predator may leave. If this is true, then the relationship between the grebes and terns would not be parasitic. Instead it would be mutualistic, a term used to describe a relationship in which each individual involved derives some benefit from its association with another.

Artificial Islands

When the first European settlers came to North America there were about 127-million acres of fresh and saltwater wetlands on the continent. Today, after hundreds of years of draining and filling for agriculture, flood control, and housing, fewer than 75-million acres remain. Because wetlands are synonymous with breeding habitat for waterfowl, the number of ducks and geese in North America likewise has declined.

Nowhere is the decline more pronounced than in the Prairie Pothole Region, that part of the Great Plains extending from South Dakota north to the boreal forests of Saskatchewan and Alberta. This region, about 1,000 miles long and 300 miles wide, is dotted with hundreds of thousands of small ponds and is the most important waterfowl breeding area in North America.

The portion of the Prairie Pothole Region within the United States once covered 74-million acres and produced about 15-million ducks each year. More than half of this region has been drained, and now it produces only about 5-million ducks yearly. Recently, loss of wetlands has been slowed somewhat because of a better understanding of their ecological values, and through legislation. But legislation can't bring back lost acres or dead ducks. Is there any way to bolster flagging waterfowl populations?

One method may be to construct artificial nest islands. Waterfowl biologists know that both ducks and geese nesting on islands produce more young than waterfowl nesting on mainland. This is primarily because island nesters are less likely than mainland nesters to have their young eaten by predatory mammals such as raccoons, skunks, and badgers.

To explore the use of artificial islands by waterfowl, Jean-Francois Giroux of Ducks Unlimited, Canada, examined more than 1,000 duck and Canada goose nests on artificial islands near Brooks, Alberta ("Use of artificial islands by nesting waterfowl in southeastern Alberta," *Journal of Wildlife Management*, vol. 45, pp. 669–679).

The islands were located in several small ponds built by Ducks Unlimited, and were made of piles of earth. All the islands had vegetation, and ranged in size from .1 to .5 hectares (.25 to 1.25 acres).

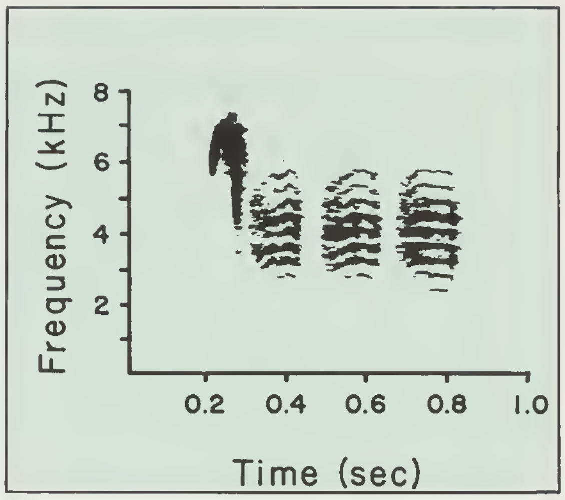
As expected, Giroux found that the islands were used heavily by breeding ducks. Some islands had as many as 29 duck nests per hectare, whereas typically the mainland has less than four per hectare. Mallards, gadwalls, and lesser scaup used the islands most frequently. Numerous Canada geese also used the islands, while only one pair nested on nearby mainland.

Giroux concludes that constructing artificial islands is a promising management technique for enhancing waterfowl productivity. Even if such islands serve only to attract waterfowl that would otherwise nest on the nearby mainland, reproductive success should increase because of reduced predation.

Eleanor Alexander

A Question of Identity

by Stephen Nowicki



A sonogram or audiospectrograph of a "chick-a-dee-dee-dee." Sonograms are made by a stylus that transfers frequency patterns to a moving paper belt.

OF ALL THE SOUNDS of winter, the ones I find most memorable are the squeak underfoot of very cold snow, and a startled "chick-a-dee-dee-dee" off in the distance. What is the chickadee saying? "Hey, you!" or "Over here!"? Or does the sound mean more?

Several years ago a fellow graduate student and I began investigating this question. From the research we were doing at Cornell University, we knew that by September black-capped chickadees had formed flocks of eight or more members, including adults and juveniles of both sexes. Flocking is not unusual—many birds, such as blackbirds, form aggregations after breeding, sometimes numbering in the thousands. The unusual thing about chickadee flocks is their small size and constant membership; there is a strong tendency for a group of birds to stay together from late summer until the following spring. Furthermore, unlike other winter-flocking birds, chickadees will vigorously defend a flock territory. These territories probably ensure that the birds will have sufficient food throughout the winter.

The chick-a-dee call is heard most frequently during boundary disputes between neighboring flocks. These interactions are interesting to watch and hear. In intense conflicts, birds fly rapidly toward each other, tumbling through trees and bushes like crazed acrobats, all the time calling "chick-a-dee" rapidly and loudly. Similarly, the discovery of a roosting owl elicits a chorus by the entire flock as they mob the predator. A bird will also call if it is separated from its flock. The contexts of the call suggested to us that it played an important role in a flock's cohesion. We hypothesized that the chick-a-dee call contained information about the identity of the calling bird and its flock.

To test our predictions we first had to recognize individual birds. This meant catching several flocks with mist nets and banding each member with a unique combination of colored, plastic leg-bands. When possible, we determined the sex and age of each bird. By late October we had banded five flocks and felt confident that we knew their members and territories. Then we began to collect hundreds of recordings of calls. We did this by observing our flocks on frigid mornings and waiting until an individual bird called within range of our binoculars and microphone. The hardest job, acoustically analyzing these vocal signals in the laboratory, was the next step.

Any sound, from symphonies to bird songs, can be characterized in a number of ways. In our analysis, we were most interested in the "dee" syllable. It has acoustical energy at a series of frequencies, layered one on top of another. We reasoned that this complex sound provided a basis for vocal differences. Altogether we analyzed about 500 calls, including several thousand "dees."

Our analysis revealed a wealth of variations among the calls of different individuals. This finding was not surprising since many species of birds (white-throated sparrows, for example) are known to distinguish individuals by their voices. More interesting was our finding that each flock had its own vocal characteristics, almost like an accent. This meant that a bird not only identified itself when it called, but also potentially identified its flock. I say potentially because, although we had demonstrated that differences between flocks existed, we had not proven that the chickadees recognize these differences.

To obtain proof, I devised a test to see whether chickadees responded differently to calls of their own and of a different flock. First I attracted a flock to a feeder near the edge of its territory. Then, using a loudspeaker, I played calls of this flock and those of a foreign flock. The results of these playback experiments were striking. A flock barely responded to its own recorded calls, but reacted aggressively when calls of a foreign flock were played. This demonstrated that chickadees do recognize flock membership on the basis of voice.

The chick-a-dee call is used as a warning, as a rallying cry in territorial defense, and as a contact note. It may serve other functions too. In each case, when a bird emits this signal it is identifying both itself and its flock membership.

Why should chickadees do this? Perhaps the invariant plumage of these birds and their thick, brushy habitat make recognition by other means difficult. A flock-specific vocal signal may enable a bird to distinguish its own flock's members from other chickadees in the confused jumble of a territorial conflict. Perhaps the chick-a-dee call is a form of commitment, an investment by each individual that ensures loyalty to a particular flock throughout the winter.

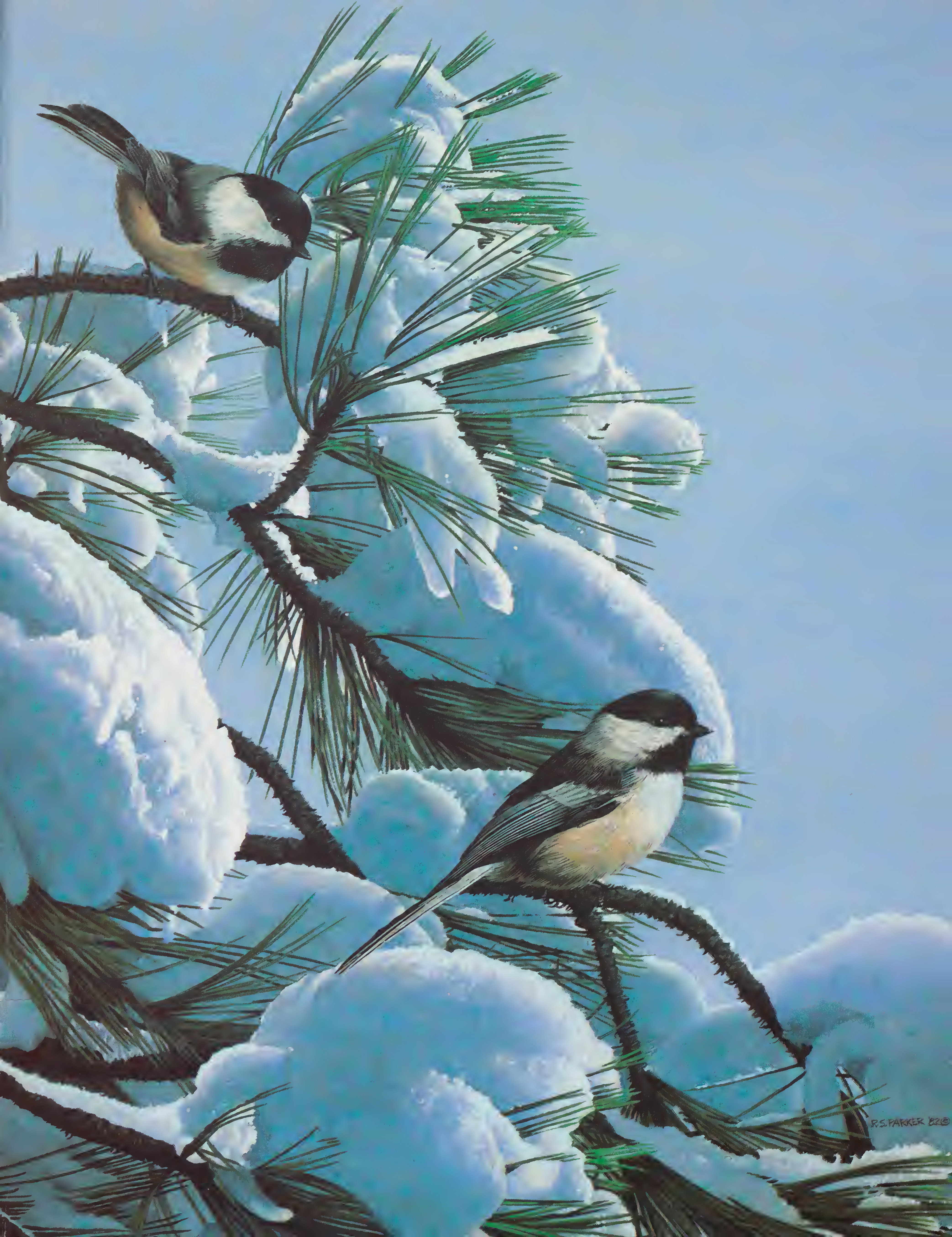
FURTHER READING

Gurin, J. "There's a Lot More to Birdsongs Than the Sound of Music." *Smithsonian.* April, 1982.

THE AUTHOR

Stephen Nowicki is a Ph.D. candidate in the Section of Neurobiology and Behavior at Cornell University.

Facing page: Snow on the Pine—Chickadees. Painting by Ron Parker. Courtesy of the artist and Mill Pond Press, Inc., Venice, Florida 33595.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FRONT COVER. White-throated sparrow. Photograph by Wayne Lankinen. Our thanks to Andrew J. Schroder, II for his generous gift.

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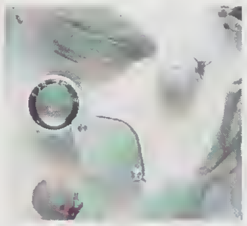
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Kirtland's Warbler: Why So Rare?

by Harold F. Mayfield

RARITY IS THE HALLMARK of the Kirtland's warbler. Named after Cleveland physician and naturalist Jared P. Kirtland, the entire species consists of about 200 pairs, all of which nest in a tiny region of northern Michigan, and winter in the Bahama Islands.

Biologists suspect that the Kirtland's warbler was a rare bird long before it was discovered, yet it seems hard to imagine that the species has teetered upon the brink of extinction during its entire history. Its specialized nesting habitat, stands of small jack pines growing on dry, sandy soil, was probably much more extensive a few thousand years ago when the retreating Wisconsin glacier left sandy outwash plains in its wake.

Our earliest accurate information on the size of the Kirtland's warbler population was obtained in 1951 when it became the first songbird in the world to be censused completely. At that time there were 500 singing males, presumed to represent 500 pairs. Between 1961 and 1971 the population plummeted to about 200 singing males, where it has remained for almost 15 years despite efforts to assist the species. This tiny population, all of which could fit in one shopping bag, is but a drop in the ocean of North American birds.

Why is the Kirtland's warbler so rare? To answer this, biologists look first at the bird's habitat. But which habitat—nesting or wintering—or the migration route traversed twice each year?

We have a few clues. Whatever is holding back the present population affects mainly the young in their first year of life. Adults enjoy excellent survival rates, about 65 percent from one nesting season to the next, and they produce young at rates comparable to those of more abundant species, about three fledglings a year. Yet only about 23 percent of the fledglings survive their first year. Compared with other warblers, this is a poor showing.

Nesting Habitat

Nesting habitat is the ultimate limiting factor in this species as in all others. For the Kirtland's warbler the required habitat is particularly distinctive and restricted. The bird nests only in extensive stands of Christmas-tree-size jack pines growing on dry, sandy soil with low ground cover. Under natural conditions this habitat is maintained

The Kirtland's warbler nests only in stands of small jack pines. Below, a branch and female cone: since the cones are opened only by the heat of a forest fire, frequent fires, right, are necessary to ensure a continued supply of nesting habitat for this rare bird.

Albert Kuhnigk (Valan Photos)

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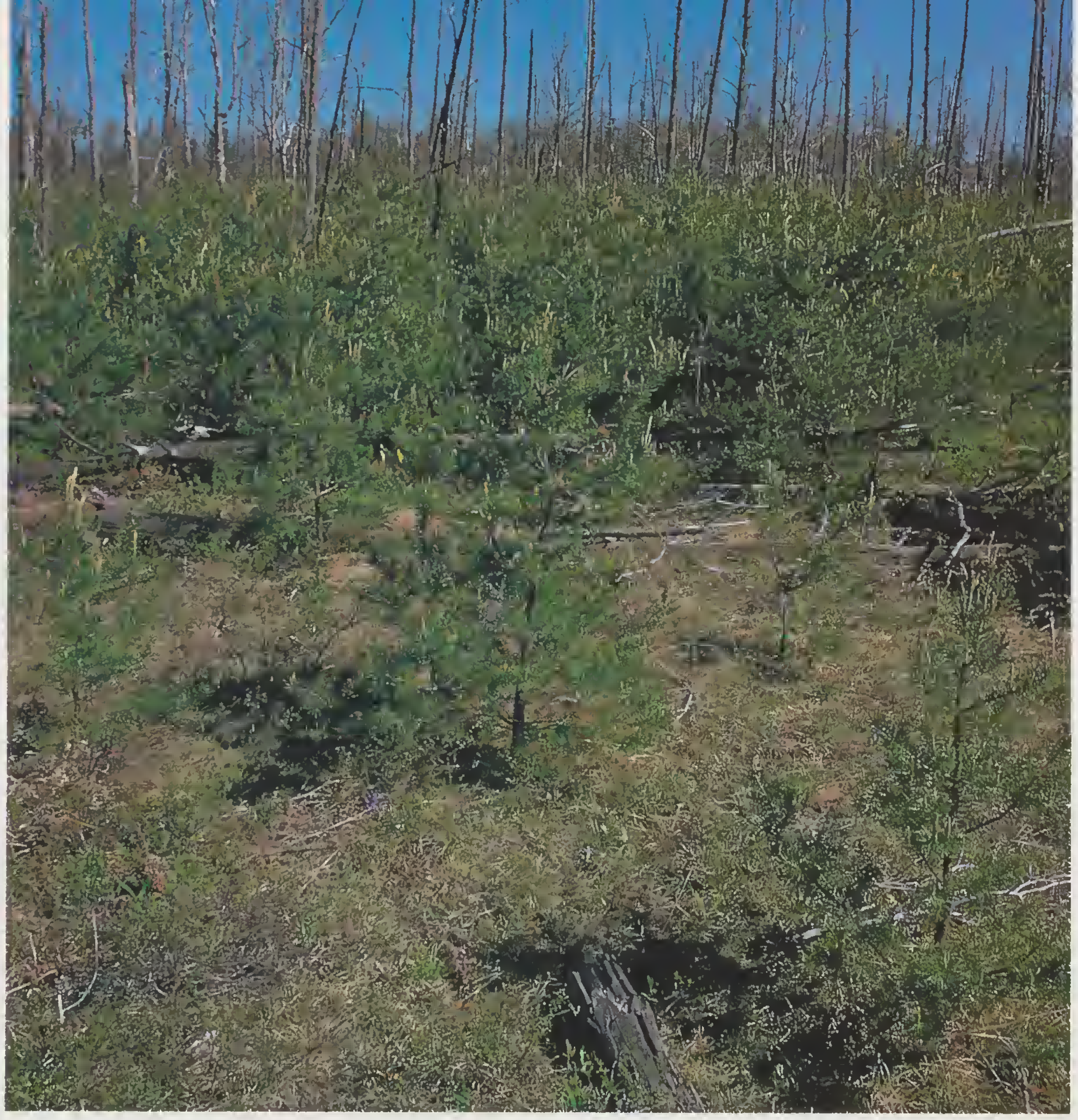
Soon after a forest fire, open cones, below, lie among the "fiddleheads" of newly emerging ferns. A few years later, right, the habitat will be suitable for Kirtland's warblers.



John Shaw

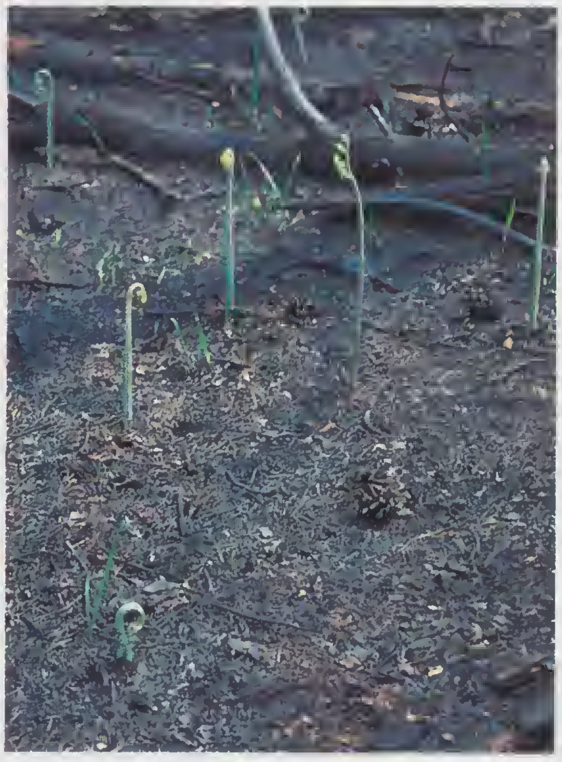
only by forest fire and therefore occurs only in scattered tracts. Although jack pines grow across the continent from Nova Scotia to British Columbia, the exact requirements of this bird seem to be provided in just three counties of northern lower Michigan.

Why the Kirtland's warbler is restricted to its narrow ecological niche is not clear. The reasons probably lie in a combination of factors. Perhaps the requirement is not just the tree species but the shape or form of the trees and the rest of the surroundings, including the ground cover. When the natural habitat is approximated by planting, but with red pines substituted for the jack pines, the birds will nest in it. Perhaps other conifers would be accepted also. Actually, the warblers do not place their nests directly in the trees. They embed the nests in the sand under low ground cover. They use the pines for foraging and concealment, but for these purposes it would seem that other kinds of vegetation would do as well.

If the bird has any special food requirement, we have not detected it. It seems to eat whatever insects are abundant in the trees and ground vegetation. However, the nature of the soil seems to be important. All nests found to date have occurred on one soil type, Grayling sand. On this porous and sterile base the warbler finds good drainage under its nest and stunted ground cover to conceal eggs and nestlings. This poor soil with its sparse fauna also provides a measure of sanctuary from competitors and predators. Significantly, none of its avian associates, such as the vesper sparrow and hermit thrush, are limited to this special habitat. In fact, all of them flourish better elsewhere.

In primeval times the nesting habitat was renewed by sporadic forest fires set by lightning, Indians, or settlers. The period of heavy lumbering, around the 1870s, brought fires on a vast scale, described by some observers as "the burning of an empire." Slashings were left on the ground to be ignited by people or lightning. The damage was often tragic, but the enormous tracts of burned land soon covered by young pines were a boon to Kirtland's warblers.

Harold Mayfield



For the past 100 years, however, the nesting habitat has been shrinking along with the Kirtland's warbler population. Jerome Weinrich, biologist in the Michigan Department of Natural Resources, has estimated that the habitat decreased 40 percent from 1961 to 1971, a period in which the population declined 60 percent. The number of accidental fires has increased in modern times, but the ability to fight them has improved and they are usually held to small tracts.

To make sure some of this unique habitat is preserved, four tracts comprising more than 11,000 acres were set aside between 1957 and 1961 to be managed permanently for the benefit of Kirtland's warblers. More recently, under the Endangered Species Act, habitat preservation efforts have expanded to include 135,000 acres. If a substantial increase in the population is attained, it certainly will require an increase in the amount of nesting habitat.

Still, if the habitat requirements are seen simply in terms of space available for nesting, the bird does not seem to be approaching the limit. To our eyes the warbler does not fill all available space. While defended territories average about eight acres, nesting colonies occupy enough space to allow 30 acres per pair. Also, territories are seldom contiguous with others on all sides as though crowded. Sometimes nearby areas look suitable but have no Kirtland's warblers. Perhaps the birds see something we do not, or perhaps there are not enough of them to fill the habitat.

Cowbird Threat

Early in the last century the encroachment of settlers in southern Michigan had a profound effect on the Kirtland's

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Kirtland's warbler nest and eggs, below. In these nests a female brown-headed cowbird, left, lays her egg which the host bird raises to the detriment of its own young.

warbler. The spread of agriculture across the midwest replaced much of the forest with fields and pastures. The newly opened land provided a favorable environment for many birds of the western grasslands, which expanded their ranges north and east to the Michigan pinelands. One of these was the brown-headed cowbird, which entered the region about 1880.

The cowbird is a nest parasite. It removes eggs from the nests of other birds and lays its own in their place. Some host species accept the foreign eggs and raise the young as their own. Because the cowbird is larger than most of its hosts and has a shorter incubation period, host young usually do not fare as well as the young cowbirds. Usually only a modest number of nests are parasitized.

Not so for the Kirtland's warbler. In the 1960s, 70 percent of Kirtland's warbler nests were used by cowbirds, with production of young depressed to less than one fledgling a pair per year. Calculations based on previous reproductive and survival rates led to the conclusion that the Kirtland's warbler needed help or the last one would vanish before 1980.

Conservationists were alarmed and promptly set in motion steps to rescue the bird. Plans involved an increase in the amount of habitat, but since jack pines need about eight years to reach the required size, these measures did not promise quick results. Cowbird control was a different matter; cowbirds can be removed effectively from the vicinity of nests by trapping. Several agencies cooperated in trapping efforts—National Forest Service, U.S. Fish and Wildlife Service, Michigan Department of Natural Resources, and Michigan Audubon Society. Cowbird control was highly successful, and cowbird molestation was reduced almost to the vanishing point. Production of young warblers improved to more than three fledglings a pair per year, which laid to rest any doubts about the fecundity of the species.

Thus the most acute problem was solved. But alas, the population did not rebound as expected. Annual counts still waver around 200 pairs. While it is disappointing not to see a substantial increase, there is satisfaction in having arrested the precipitous decline.

Wintering Experience

Nearly everything we know about this bird is limited to the four months it spends on its nesting range. The greater part of each year is spent in the Bahama Islands, where its habits are virtually unknown. People have reported glimpses of the warbler in the Bahamas, but no one has been able to maintain sight of it for very long. Since it does not sing in winter and does not congregate, it is exceedingly difficult to find. I have tried unsuccessfully on several occasions. The Bahamas may look small on the map, but they consist of 700 islands, cays, and rocks, most of which are covered by dense scrub. A few hundred warblers dispersed among them are so many needles in haystacks.

The Bahamas have changed greatly since the height of the last ice age 18,000 years ago when the breeding range of the Kirtland's warbler was probably much more extensive than now. At that time so much of the world's water was bound up as ice on the continents that the oceans were about 400 feet lower, and with their shallows high and dry, these islands were vastly larger.

In recent centuries, however, the islands have changed little. Unlike many other tropical regions, these scrub forest lands have not been attractive for agriculture, and most human inhabitants have turned their attention to the sea. Pines grow on only the four northernmost islands, which have been lumbered and burned piecemeal for a very long time. But we are not even sure the pines have significance to the survival of Kirtland's warblers, since most modern sightings have been on islands without pines.

Bill Dyer© (Photo Researchers, Inc.)

Biologists don't know why this warbler nests only in jack pine stands when it builds its nest on the ground. Just 23 percent of the fledglings, below, survive the first year.

> *"This tiny population, all of which could fit in one shopping bag, is but a drop in the ocean of North American birds."*

Betty Darling Cottrille

We cannot rule out unidentified problems on the wintering ground. Ecologist Steve Fretwell, formerly at Kansas State University, has hypothesized that the Kirtland's warbler may be under pressure from avian competitors, especially abundant winter visitors such as the palm warbler and prairie warbler. If these have a successful breeding season they may crowd the wintering areas. This idea is hard to evaluate since we know nothing about the fluctuations and interrelations of these birds.

Migration

As we consider each phase of the annual cycle, the problem of migration deserves attention. On long-distance flights we might expect losses to fall most heavily on inexperienced birds, the focus of our concern. In all species the young are more likely to stray outside the normal routes in migration. In abundant and adaptable species this trait may have value in pioneering new areas and mixing genetic strains. However, stray Kirtland's warblers have no future and such losses may not be affordable.

To see this problem in perspective, let us look at a more successful bird similar to the Kirtland's warbler, the prairie warbler. This bird also migrates to and from the Bahamas. The survival rate of adults is comparable to the Kirtland's warbler and its production of young may even be a bit lower. Yet its population is sustained. Why?

In the prairie warbler, and most other migratory songbirds, a very small proportion of yearlings, 4 percent or less, return to the site of their hatching. The others disperse widely. Because they range from Kansas to the Atlantic coast, prairie warblers may miss their birthplace by hundreds of miles and still find suitable habitat and mates. The Kirtland's warbler, however, must migrate with pinpoint accuracy or find itself separated from others of its kind.

We know that individuals do stray. In 1978 four misdirected males were found, two in Wisconsin, one in Ontario, and one in Quebec. None had mates. Each chose plausible habitat and sang persistently until the breeding season waned. Strays also have been discovered in other years.

Accurate navigation has been a requirement of the Kirtland's warbler for centuries, but in recent years the problem has grown more acute. In 1961 the distance across the breeding area was 100 miles; by 1983 it was 40 miles. At the same time the area of a rectangle embracing all nests has shrunk from 6,000 to 1,300 square miles. Even these dimensions do not fully portray the searching feat because within the range the nesting sites occupy only a few scattered patches.

Thus the Kirtland's warbler, while facing the usual problems of survival among migratory songbirds, in addition has special problems as a consequence of its own rarity.

Postscript

To nonscientists it may be encouraging to learn that, even in the most thoroughly studied species, much is still unknown. One of the attractions of bird study is that the amateur can make valuable contributions by observation and meticulous notes. In the case of the Kirtland's warbler there is a high probability that the mysteries on the wintering ground will first be pierced by an amateur bird watcher on vacation in the Bahama Islands.

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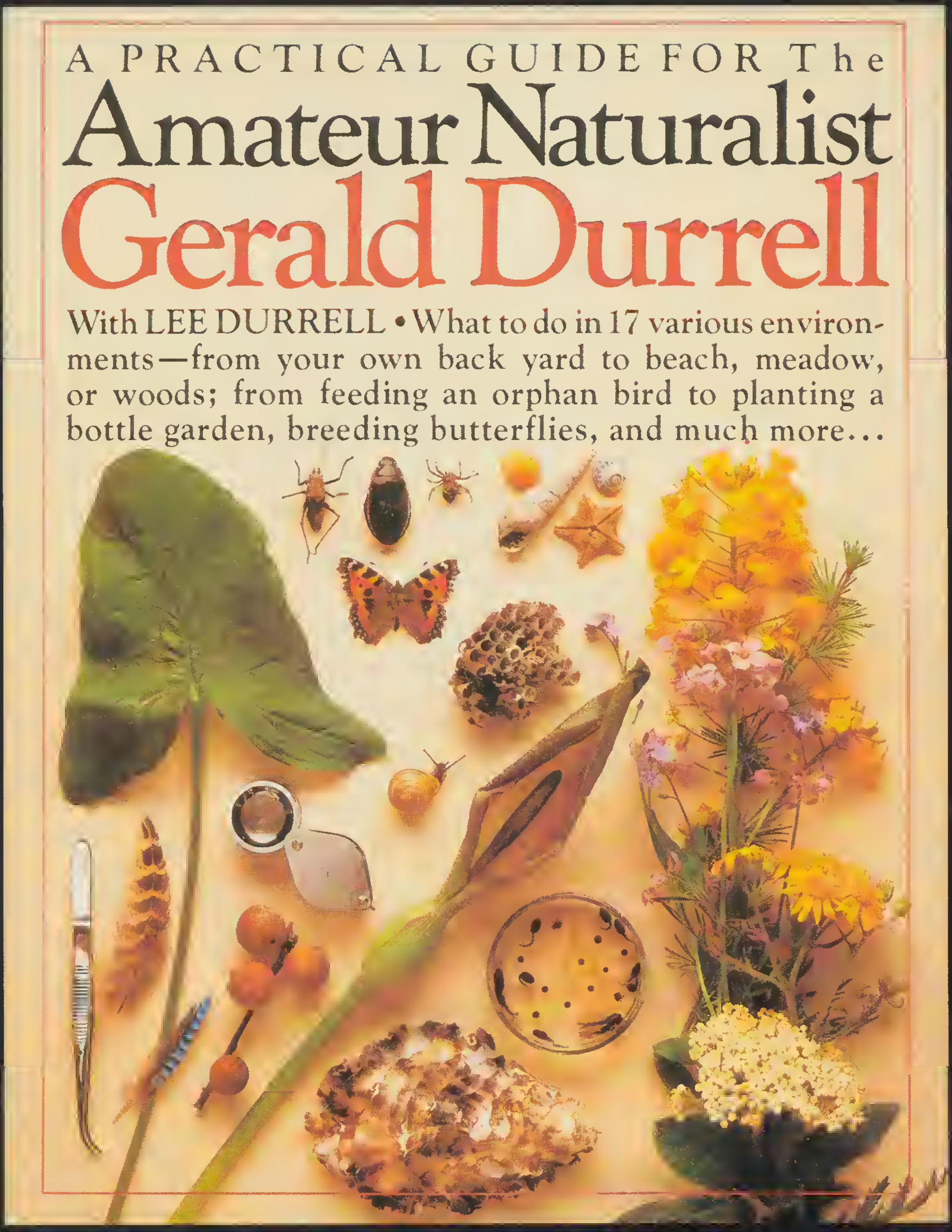
THE AUTHOR

Harold Mayfield is former president of the American Ornithologists' Union and present member of the Kirtland's Warbler Recovery Team.



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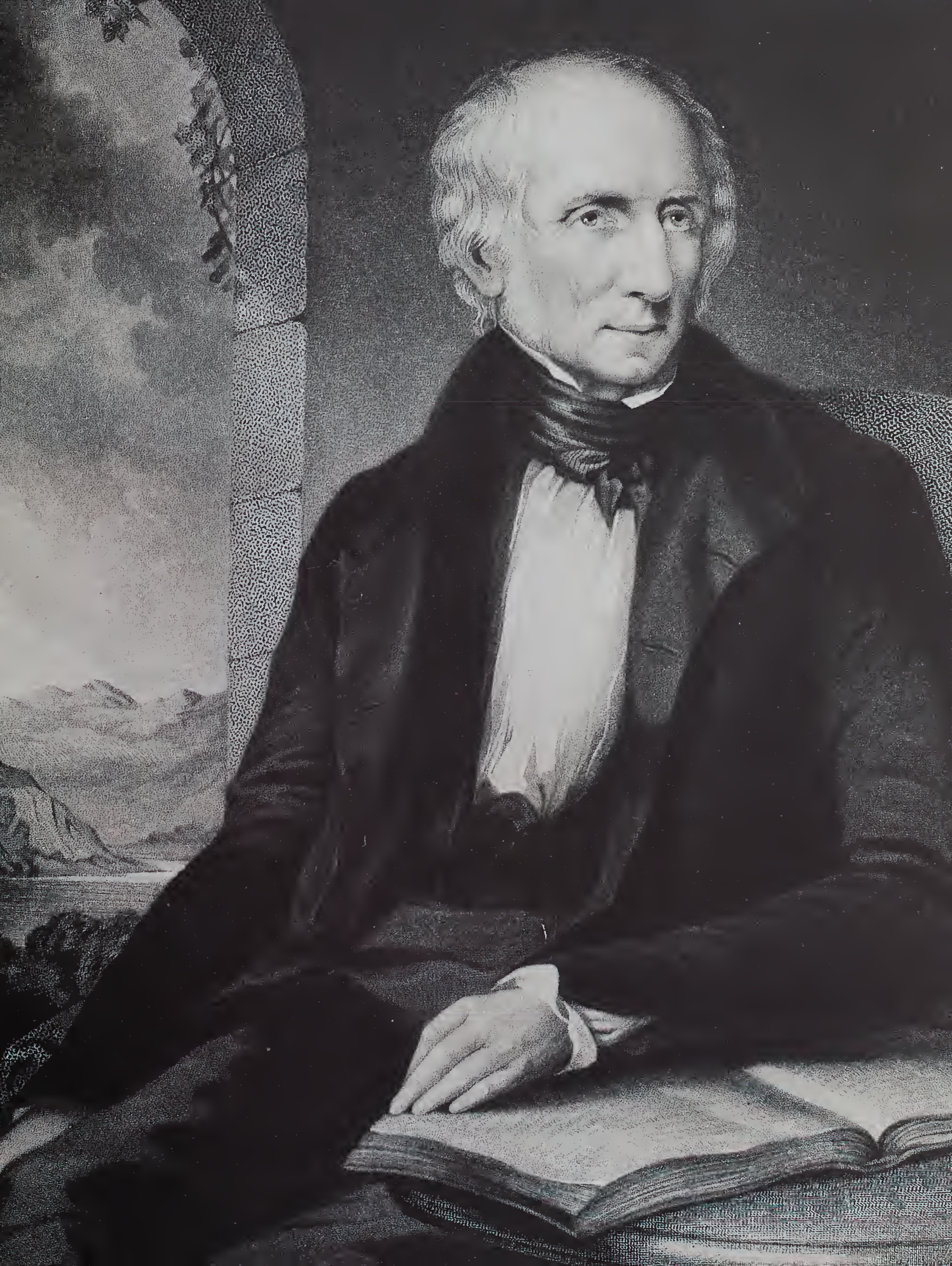

TOO HAPPY IN THINE HAPPINESS

by Samuel A. Eliot

BIRD SONGS play many roles in our lives. They are objects of scientific scrutiny, signals of seasonal change; they evoke feelings and inspire poets. The gloom of an April morning can be lifted by the song of a robin. Biologists tell us the robin sings to assert his territorial imperative or attract a mate, but this does not explain the way the robin's song makes us feel.

Poetry does attempt to describe those feelings, particularly the poems of 19th-century England. Poets of that time were grappling with the place of humans in the natural environment and with the role of the environment in inspiring artistic creation.

Through a look at some "bird poems" of four poets of that era—Thomas Hardy, Percy Shelley, William Wordsworth, and John Keats—we may gain insight into how the song of the thrush, skylark, and nightingale made them feel and how the expression of those feelings can offer us new perspectives on our own responses.

Poet and novelist Thomas Hardy was inspired by a bird's song when he wrote "The Darkling Thrush." The main event of the poem is a thrush's song on a desolate December evening in England.

> At once a voice arose among
>   The bleak twigs overhead
> In a fullhearted evensong
>   of joy illimited;
> An aged thrush, frail, gaunt, and small,
>   In blast-beruffled plume,
> Had chosen thus to fling his soul
>   Upon the growing gloom.
>
> So little cause for carolings
>   Of such ecstatic sound
> Was written on terrestrial things
>   Afar or nigh around,
> That I could think there trembled through
>   His happy good-night air
> Some blessed Hope, whereof he knew
>   And I was unaware.

I talked with my literature class about Hardy's attribution of joy to the thrush despite the absence of any "cause for carolings" in the bleakness of the landscape. To my surprise one student expressed disdain for the poem. "It's ridiculous," she said. "Everyone knows thrushes don't sing in December at that latitude."

At the time I thought she failed to appreciate poetic license. In fact thrushes do sing in December at that latitude. My student was not only ungenerous but wrong. Moreover, listening to the taped songs of thrushes in the Cornell Laboratory of Ornithology's Library of Natural Sounds, I believe that Hardy had encountered a singing song thrush on that New Year's Eve in 1900. The thrush's song moved Hardy to imagine "Some blessed Hope" on an otherwise bleak evening, and to write a poem about it. He was one of several poets in 19th-century England who used seasonal imagery and bird song to illuminate his responses to the natural world and to articulate the impact these phenomena have on the creative process.

Hardy was so moved by Percy Shelley's "To a Skylark" that he wrote a poem called "Shelley's Skylark." In it Hardy speaks of finding the "priceless dust" of the skylark Shelley heard decades before, and consecrating it because ". . . it inspired a bard to win/Ecstatic heights in thought and rhyme." Not just Shelley's poem but the entire process of thinking about and creating the poem was inspired by the skylark's song.

Shelley's "To a Skylark" was written in June of 1820, in

Wordsworth, left. Below, was Hardy's darkling thrush a song thrush?

Derek Washington (Bruce Coleman Inc.)

Department of Rare Books, Cornell University Libraries

Ralf Richter (Ardea Photographics, Ltd.)

Skylark: Hail to thee, blithe Spirit! Bird thou never wert . . .

Italy, so there is no problem with season or latitude. But there is a problem which recurs in different guises in all the great bird poems—the poet's awareness that he may be inspired by but can never understand or attain the "profuse strains of unpremeditated art," the "unbodied joy" that is the skylark's song.

In the case of the skylark, you may hear the song or see the bird, but not both at once. The skylark sings only in flight when it is too high to be clearly visible. "In the broad day-light/Thou art unseen—but yet I hear thy shrill delight," and ". . . we hardly see—we feel that it is there." But, as anyone who has tried to spot an obscure bird knows, feeling it is there is not enough. Shelley tries to find the skylark by creating a fitting analogue for it and its song. "What thou art we know not;/What is most like thee?" he asks, and explores the question through the five senses and the animal, vegetable, and mineral realms. But none of his similies (a woman, a rose, a spring shower) is successful. His poem has been inspired by something he cannot see and for which there is no comparison.

Like Hardy in "The Darkling Thrush," Shelley attributes a feeling to the bird, saying in effect "If it sounds this good, and if hearing it makes me feel good, then the bird must be happy; and, if it is that happy, it must know something I don't." If Shelley's skylark will teach him the gladness it knows, then his art will capture the world's imagination the way the skylark's song has captured his.

Teach me half the gladness
    That thy brain must know,
Such harmonious madness
    From my lips would flow
The world should listen then—as I am listening now.

Even without knowing the skylark's "gladness," Shelley has been inspired by it to write a poem about how the skylark's song makes him feel and how those feelings heighten his awareness of himself as part of the natural world.

That the bird is at once itself and something more is another idea which pervades 19th-century English poetry. In William Wordsworth's poem, also titled "To a Skylark" the bird's song, "joyous as morning," represents both freedom from the burdens of human life and a way of lightening those burdens.

Alas! My journey, rugged and uneven,
Through prickly moors and dusty ways must wind;
But hearing thee, or others of thy kind,
As full of gladness and as free of heaven,
I, with my fate contented, will plod on,
And hope for higher raptures, when life's day is done.

Wordsworth infers from the song of the skylark the existence of "higher raptures." Hearing the song he is inspired to create a work which suggests meaning beyond the song itself.

Because the poets do not see but only hear the bird, they call it by a number of ambiguous names. Shelley calls the skylark a "spirit" and wonders if it is "sprite or a bird." Wordsworth calls it "ethereal minstrel" and "pilgrim of the sky."

In "To the Cuckoo," Wordsworth makes the ambiguity explicit.

O Cuckoo! Shall I call thee Bird,
Or but a wandering voice?
Even yet though art to me
No bird, but an invisible thing,
A voice, a mystery . . .

Wordsworth wrote two poems entitled "To a Skylark." In the first he is moved by the bird's song to reflect on his own "rugged and uneven" life. In the second he simply celebrates the bird and its song.

Leave to the nightingale her shady wood;
A privacy of glorious light is thine;
Whence thou dost pour upon the world a flood
Of harmony, with instinct more divine;
Type of the wise who soar, but never roam;
True to the kindred points of Heaven and Home!

Like the skylark and the thrush, the nightingale is hard to see, particularly when singing in "her shady wood." The best-known nightingale in English literature built a nest in the woods in Hampstead near the home of Charles Brown, a friend of John Keats, in the spring of 1819. There is little doubt that this bird was the inspiration for Keats's "Ode to a Nightingale." Brown, in his *Life of John Keats,* describes the scene: "In the spring of 1819 a nightingale had built her nest near my house. Keats felt a tranquil and continual joy in her song; and one morning he took his chair from the breakfast table to the grass-plot under a plum tree, where he sat for two or three hours. When he came into the house, I perceived he had some scraps of paper in his hand, and these he was quietly thrusting behind the books. On inquiry, I found those scraps, four or five in number, contained his poetic feeling on the song of our nightingale."

Sitting in Brown's garden under the plum tree, Keats hears the nightingale's song. Like Shelley in "To a Skylark," he is listening to a bird he cannot see. Nor can he be sure where it is beyond the uncertainty of "in some melodious plot/Of beechen green, and shadows numberless." But the nightingale's song has an immediacy that overcomes the ambiguity of its whereabouts. Singing "of summer in full-throated ease," it creates in Keats a happiness, a close-to-fatal intoxication, a "drowsy numbness" that arises from his identification with the bird. Listening, Keats longs to become more intoxicated, to "... leave the world unseen/And with thee fade away into the forest dim."

For Shelley and Wordsworth, the bird's song is an inspiration and source of wonder, but the song is clearly separate from them. For Keats, as he listens to the nightingale, this separation breaks down. Through his imagination he enters "the forest dim," seeking to achieve oneness with the singer. (We know from his letters that a few months earlier he had hoped that he was "moulting.")

Not intoxication but the power of the imagination is what releases Keats from Brown's garden in Hampstead, allowing him to—

Fade far away, dissolve, and quite forget
What thou among the leaves hast never known,
The weariness, the fever, and the fret
Here, where men sit and hear each other groan...

The process of writing the poem enables Keats to achieve not only union and release but a new perspective on life, "Where but to think is to be full of sorrow." In the imagined darkness of the nightingale's forest, Keats cannot see, but can guess that the bird is surrounded by—

The grass, the thicket, and the fruit tree wild;
White hawthorn, and the pastoral eglantine;
Fast fading violets covered up in leaves;
And mid-May's eldest child,
The coming musk-rose, full of dewy wine,
The murmurous haunt of flies on summer eves.

But even here, the violets are fading. Though it is only mid-May, the musk-rose already hints of summer evenings. And after summer, fall, and inevitably, death. Yet, in the nightingale's "embalmed darkness," death is a muse, not a threat:

Now more than ever seems it rich to die,
To cease upon the midnight with no pain,
While thou art pouring forth thy soul abroad
In such an ecstasy!

But at the very moment Keats achieves identification with the nightingale, he is reminded of his separateness from it and its song:

Thou wast not born for death, immortal Bird!
No hungry generations tread thee down;
The voice I hear this passing night was heard
In ancient days by emperor and clown...

Hans Reinhard (Bruce Coleman Inc.)

A nightingale's most outstanding feature is its melodious song.

I can hear my literal-minded student saying "That's ridiculous!" at the idea of an immortal bird in any season, at any latitude. Would her mind be eased if I suggested that the nightingale's song, not the bird itself, is immortal?

In acknowledging his separateness from the bird, Keats is reminded of his own mortality, and at that moment the nightingale flies away.

Past the near meadows, over the still stream,
Up the hill side; and now 'tis buried deep
In the next valley-glades:
Was it a vision, or a waking dream?
Fled is that music:—Do I wake or sleep?

With the departure of the unseen singer, and the fading of its song, Keats is returned to Brown's garden in Hampstead. Was that moment of transcendence real? Was it just a dream? Keats leaves the questions unanswered.

Although Keats wasn't sure if he were awake or asleep, though Shelley could neither see his skylark nor find an analogue for it, both poets were inspired by the birds' songs to write poems which brought to their creators an immortality akin to the nightingale's. In finding in nature a key to their own imaginations, Hardy, Shelley, Wordsworth, and Keats help us to understand how the joy of a bird's song can evoke in us an answering joy.

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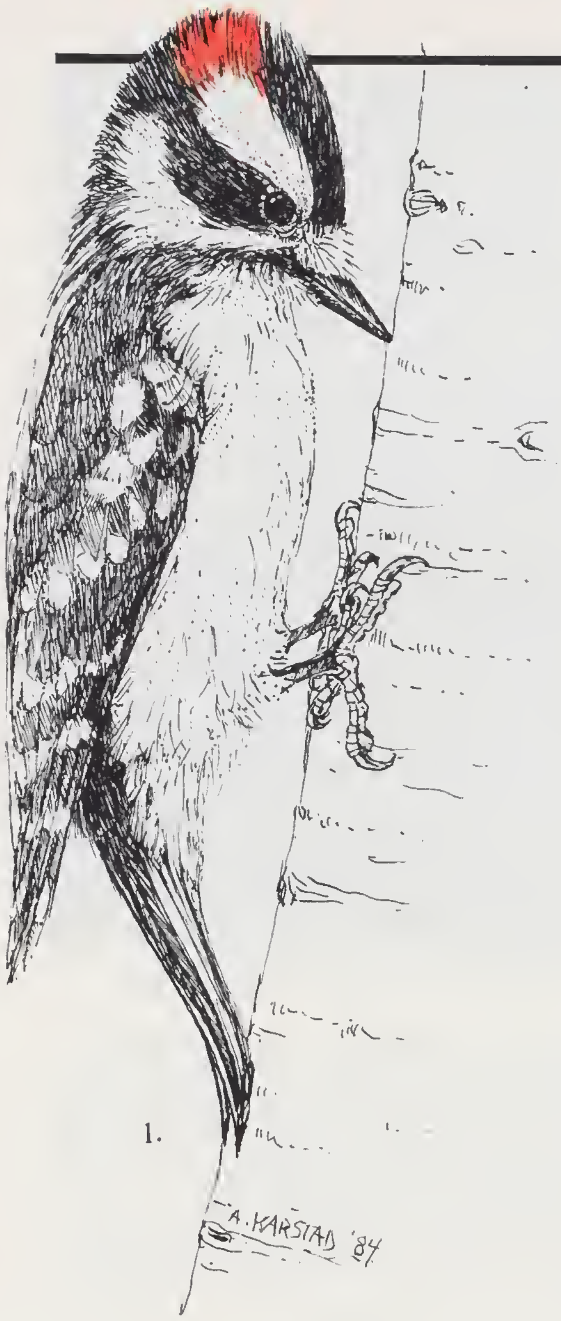

1.

FROM HOSTILITY TO AMITY

by Louise de Kiriline Lawrence *Illustrations by Aleta Karstad*

The beginnings of ritualized behavior in birds lie buried in the deep past. Rites affect virtually every species of bird and color almost every phase of their behavior, courtship and mating in particular.

Rites are movements, posturings, and vocalizations which, through repeated use, have become refined into automatic patterns of stereotyped behavior.

One of the most important functions of the rite is to forge the bond of cooperation necessary between the members of the pair. Their successful union depends on this. The normal intolerance between members of the same species must be meliorated, so that some personal recognition is established to allow the acceptance of each other's presence. In the relationships between wild creatures, rituals bridge the gap between hostility and amity.

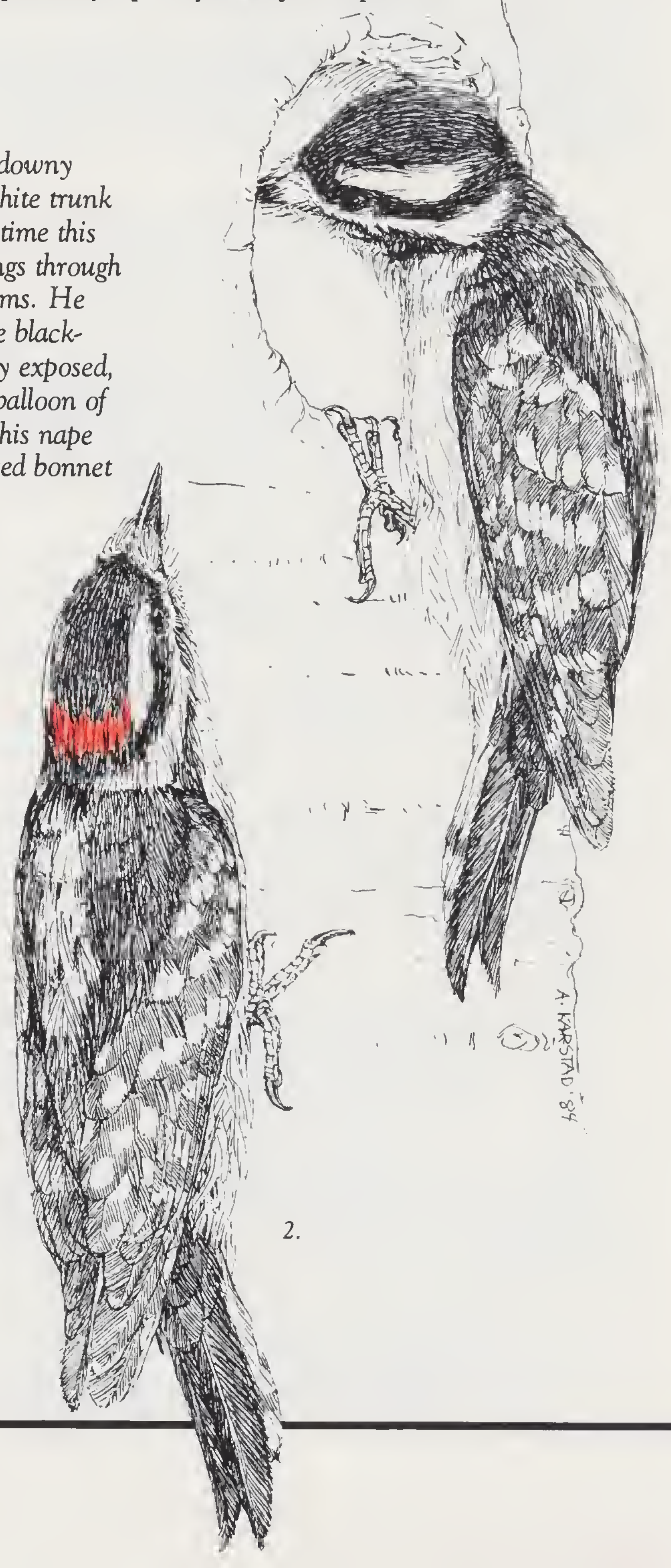
Let us follow the courtship rites of a pair of downy woodpeckers.

1.

It is March. The male downy woodpecker clings to the white trunk of the birch. For the first time this spring his whinnying call rings through the forest. The male drums. He displays—his outer white black-spotted tail feathers are fully exposed, his bill gaping, his body a balloon of soft fluffed feathers, and his nape spot, erected, looks like a red bonnet over his crown.

2.

The female's answer comes from a distance. Also she postures, her tail feathers spread wide. Thus together, but always at a distance out of sight, the pair course the forest. They call and they drum. Signals and answering signals leap back and forth between them. They posture. There is an old nest hole. The female examines it. Suddenly, the male alights below her on the birch trunk. But she flies away. They meet again, these two, as they met last spring. The attachment to the land is strong. It possesses them and brings them together each spring for as long as they live.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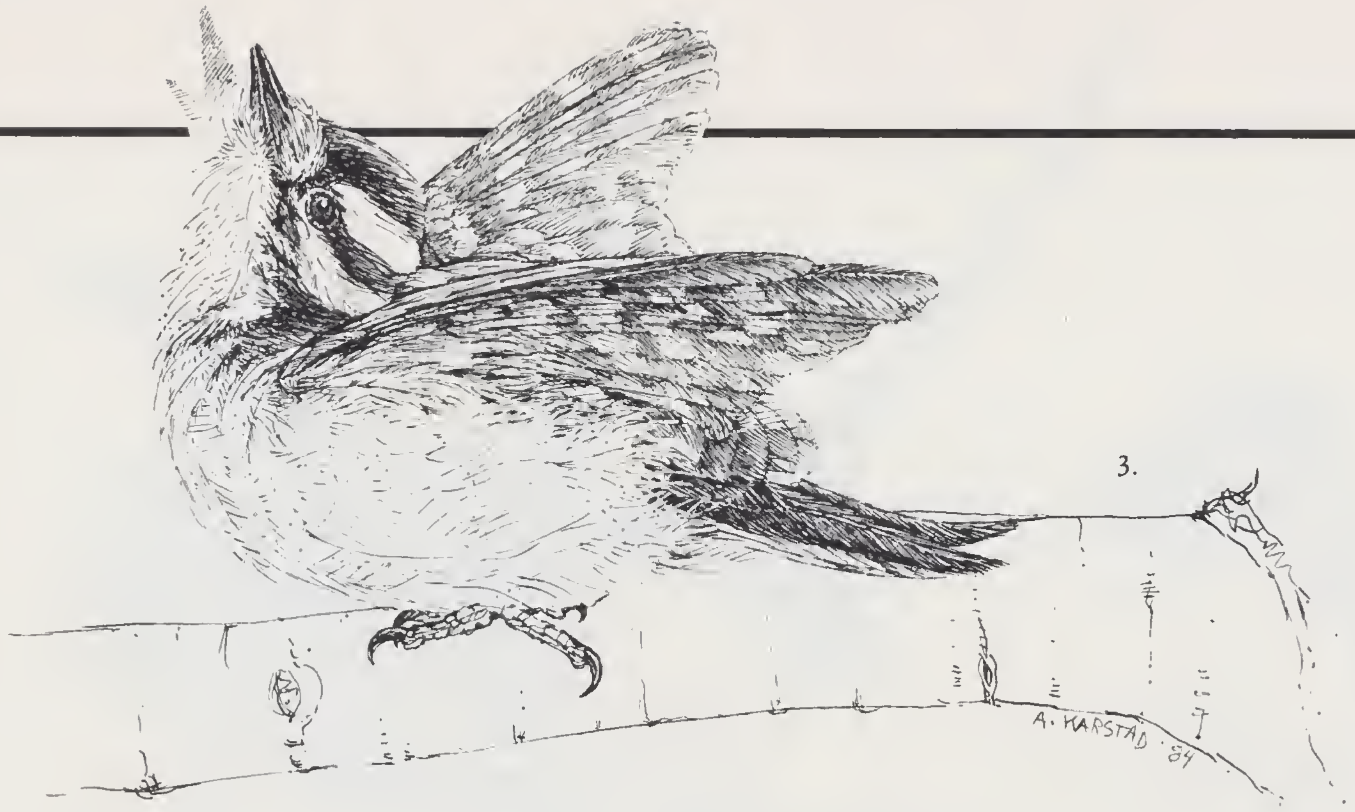
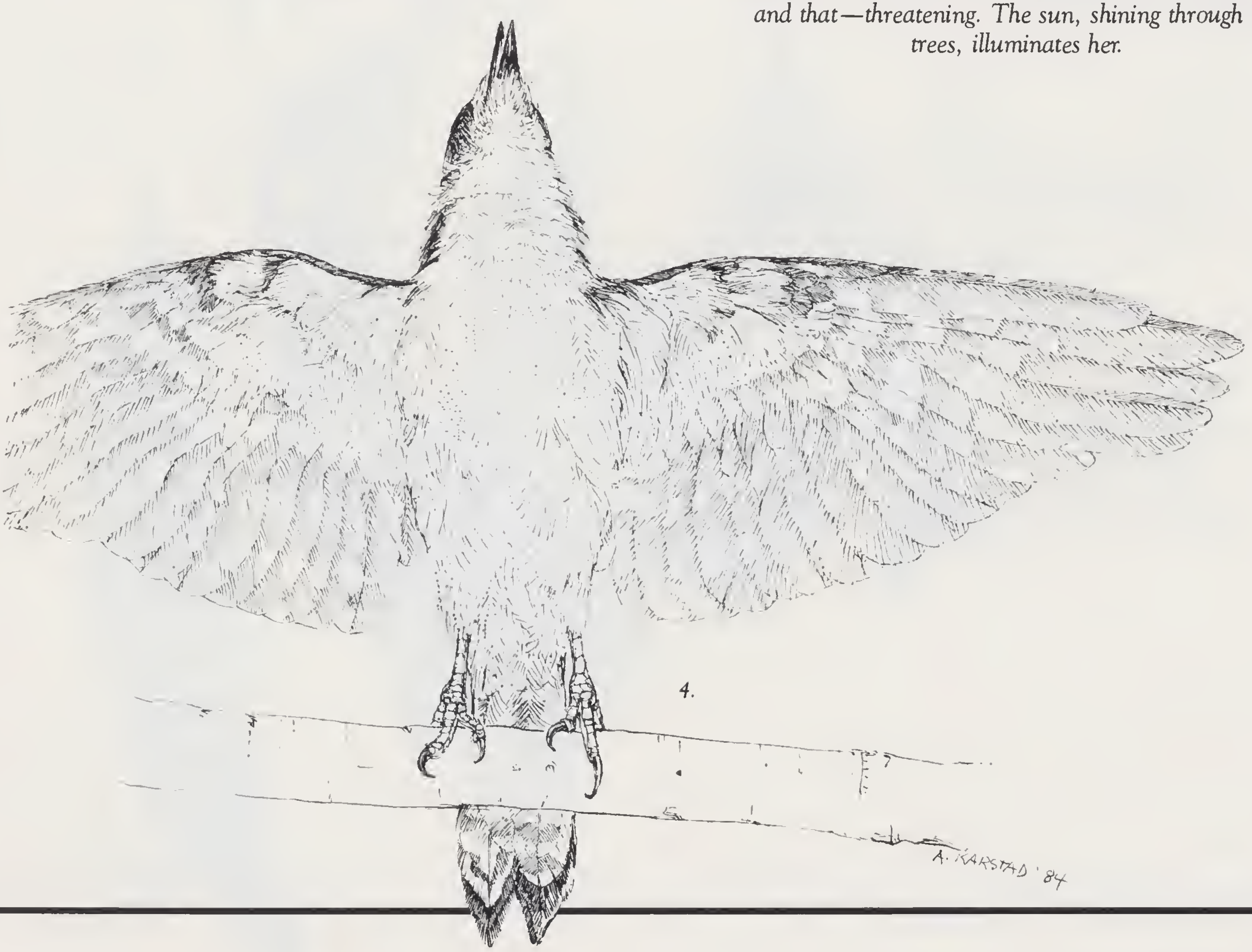


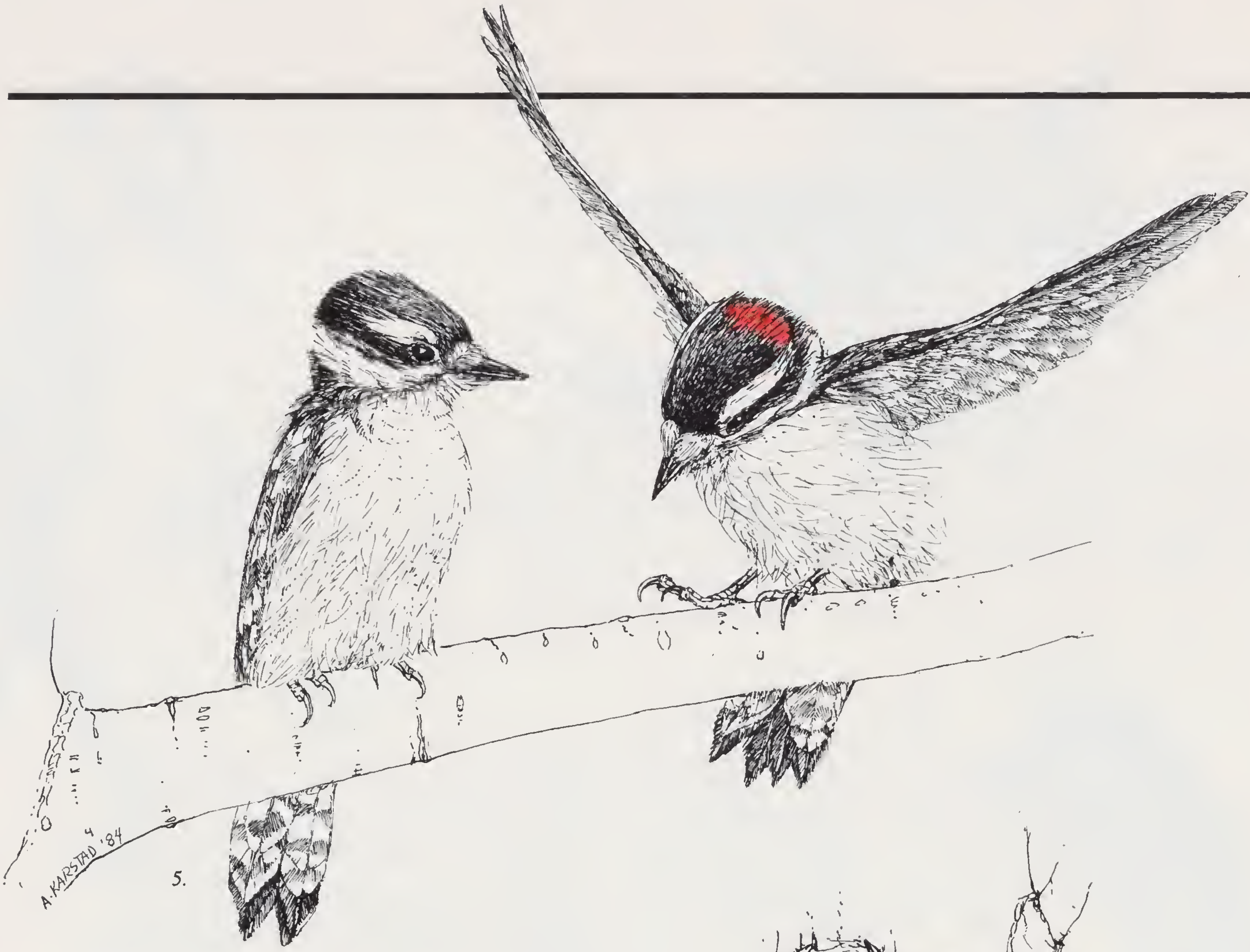
3.

It is April. An intruding downy woodpecker female flies into the nesting territory of the pair. She makes a straight line for the male. His mate, feeding in the tall poplars, dives headlong down upon the two. With her bill aiming skywards, she vigorously points it repeatedly right and left, her wings flap, her tail is spread and held flat against the support.

4.

The female attacks the intruder. She pursues her high up into the trees, and down. The male hides behind tree trunks and lets the battle of the females surge around him. At the peak of their excitement, the resident female, her bill gaping, rises on tiptoe confronting the adversary with her gleaming white-lined wings wide open. Slowly, like a weather vane, she turns her body this way and that—threatening. The sun, shining through the trees, illuminates her.





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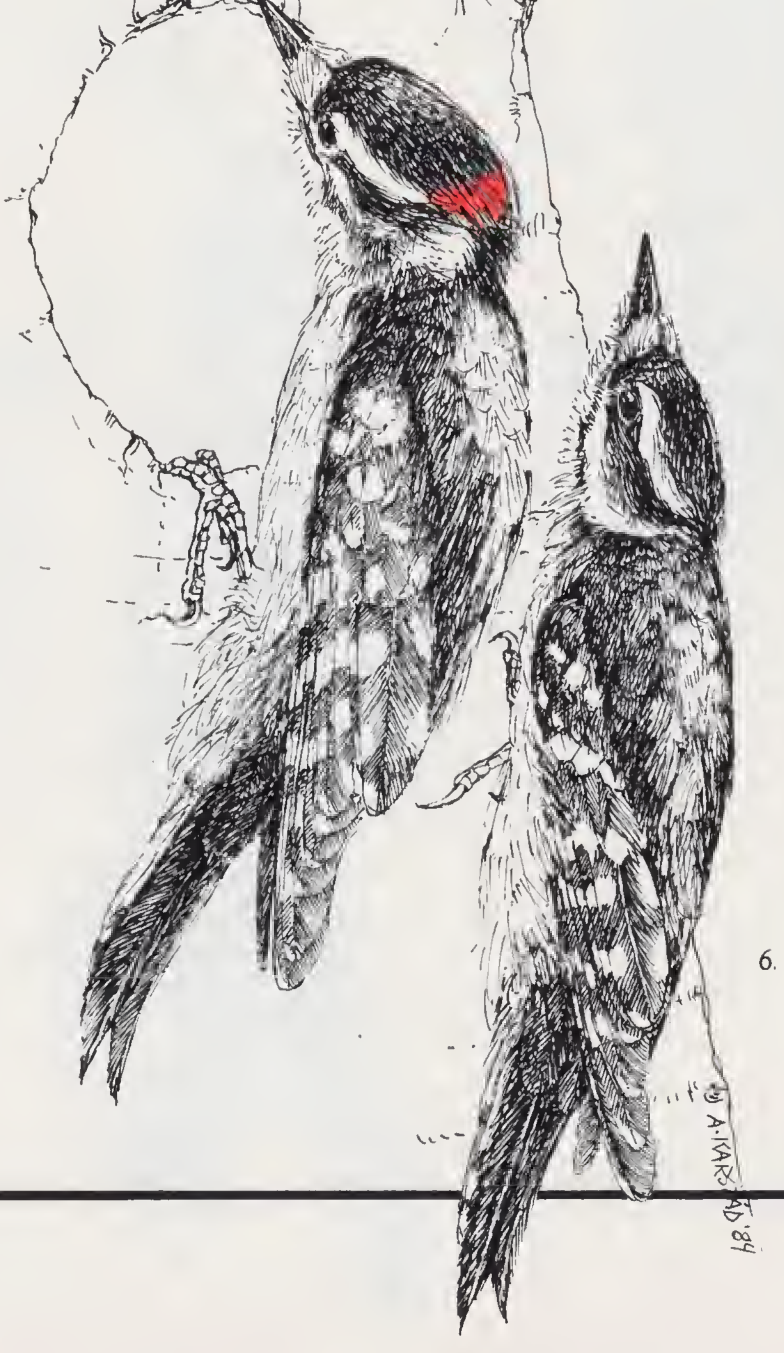


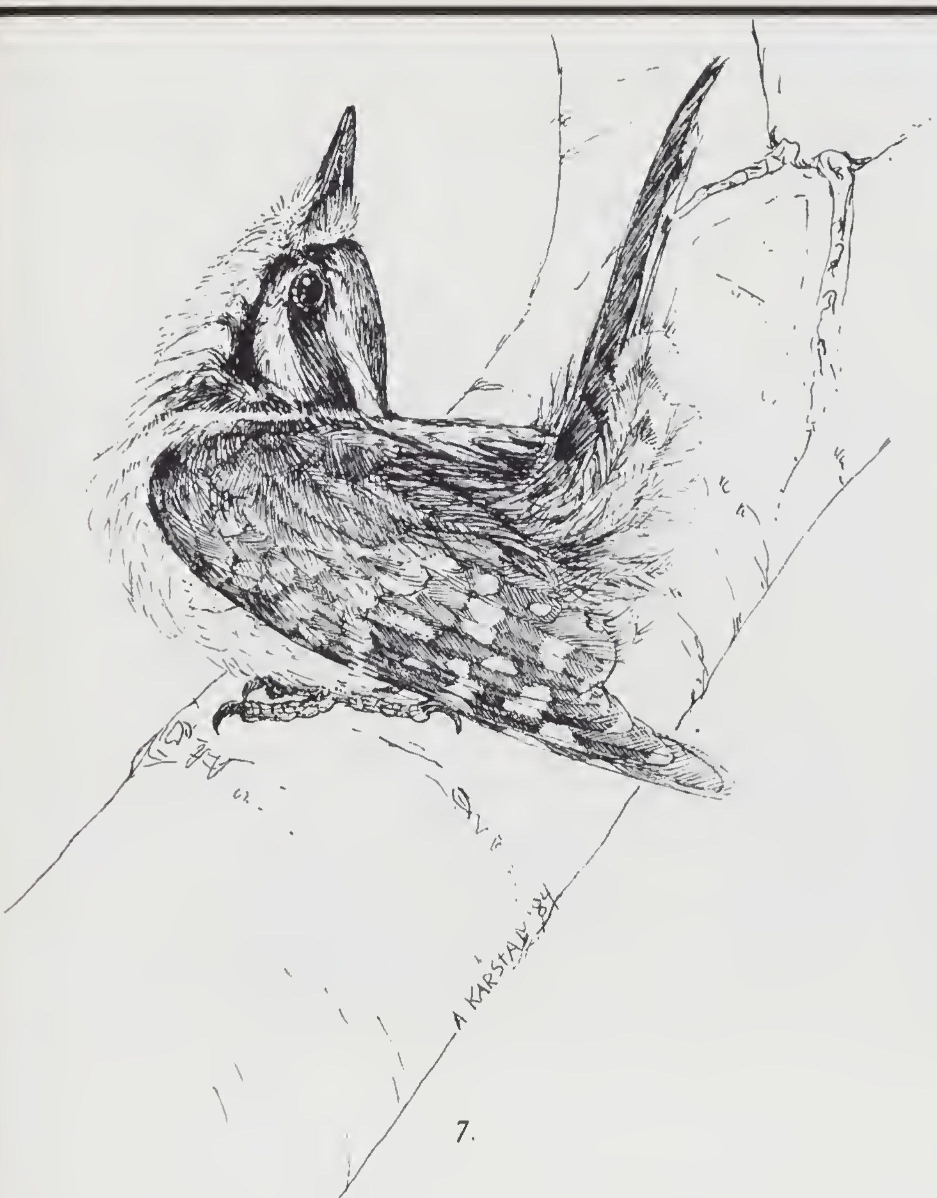
6.

5.

It's May and bursting leaves spread a tint of green over the aspen groves. The male is pursuing the female in short fluttering flights to sit beside her. But she flies away.

6.

The male is in the nest. It is now half completed. He backs out, ruffling his feathers, and clings to the edge of the opening. The female's arrival causes him to peck long and vigorously at the upper edge of the doorway. This excites the female and she flies off. The male follows.



7.

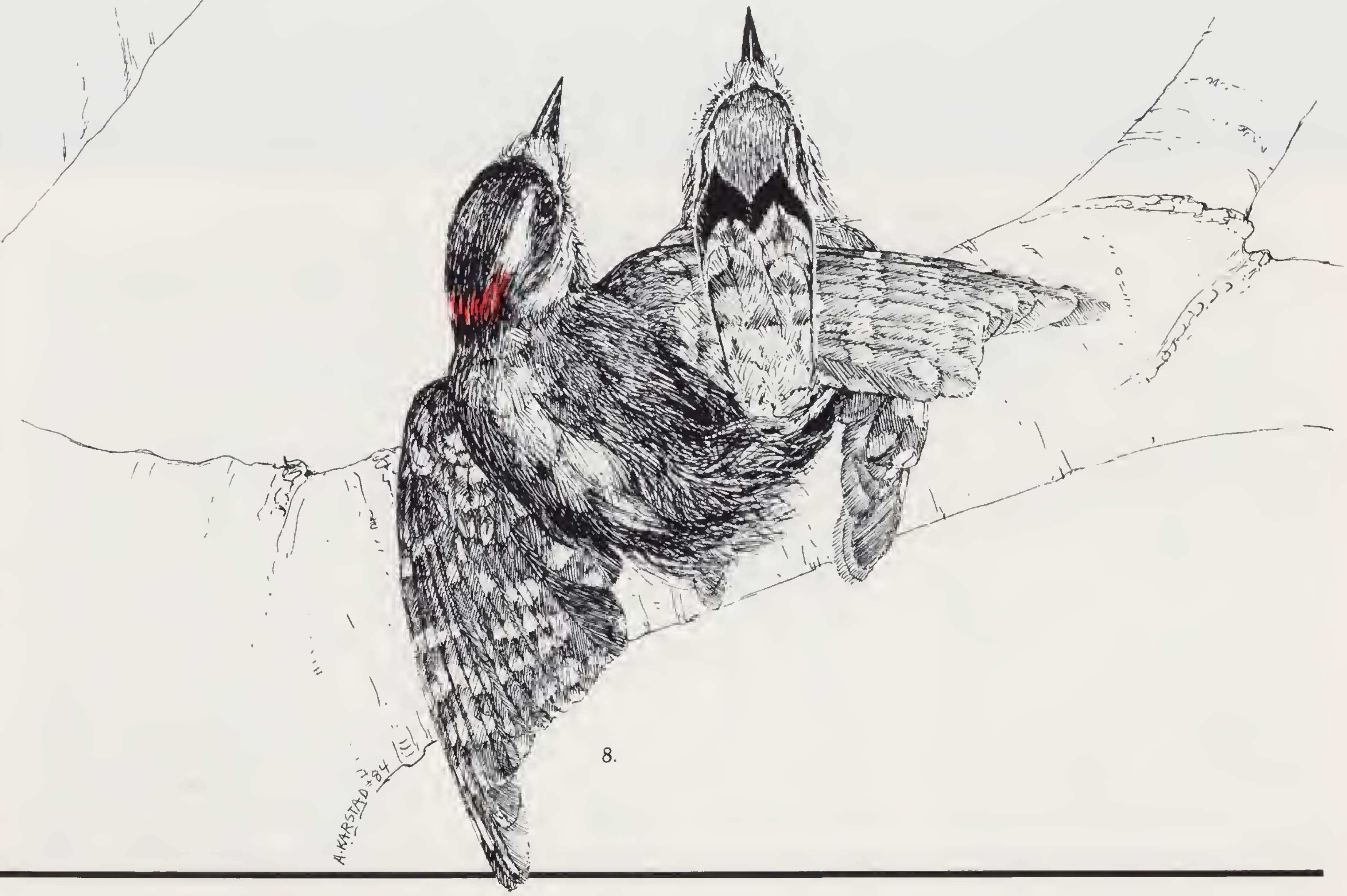
7.

The female looks out the doorway, scatters a billful of collected debris upon the gentle breeze. She emerges, flies to a horizontal branch. There she perches crosswise, tail up, head thrown back, wings loose against her sides, motionless.

8.

Attending her, the male makes his ritual advance—but hesitates, retreats. Then, once again, his wings loosened at his sides, tips trailing, and his tail down upon the branch, hop - hop - hop, he reaches the female, mounts. A firm grip on her plumage, the male swings his body under her tail, his wings spread wide, the left supporting, the other draped like a mantle across her back, and effects union.

There is no sound. The male flies away. For an instant the female remains in the dappled light of the forest, motionless. A soft whir of wings, and she is gone.



8.

Michael Fogden (Bruce Coleman Inc.)

Will the Real Noxious Model Please Stand Up?

by Susan M. Smith

A YOUNG BIRD capturing a monarch butterfly for the first time is in for a surprise, for it won't enjoy its meal. In fact, it probably will spit it out. What's more, the monarch likely tastes so bad that the bird will avoid all orange-and-black butterflies, even good-tasting ones, for the rest of its life. This is an example of the phenomenon called evasive mimicry—a highly evolved system where one species, simply by looking like another species, avoids being eaten by a third (predator) species.

The simplest form of evasive mimicry is Batesian mimicry. This involves three species: a noxious model that stings, bites, or tastes bad; a harmless mimic, which resembles the model; and a predator, which avoids the mimic because it looks so much like the nasty model. Most models possess conspicuous colors—red, yellow, orange, black—that serve as a warning to pred-

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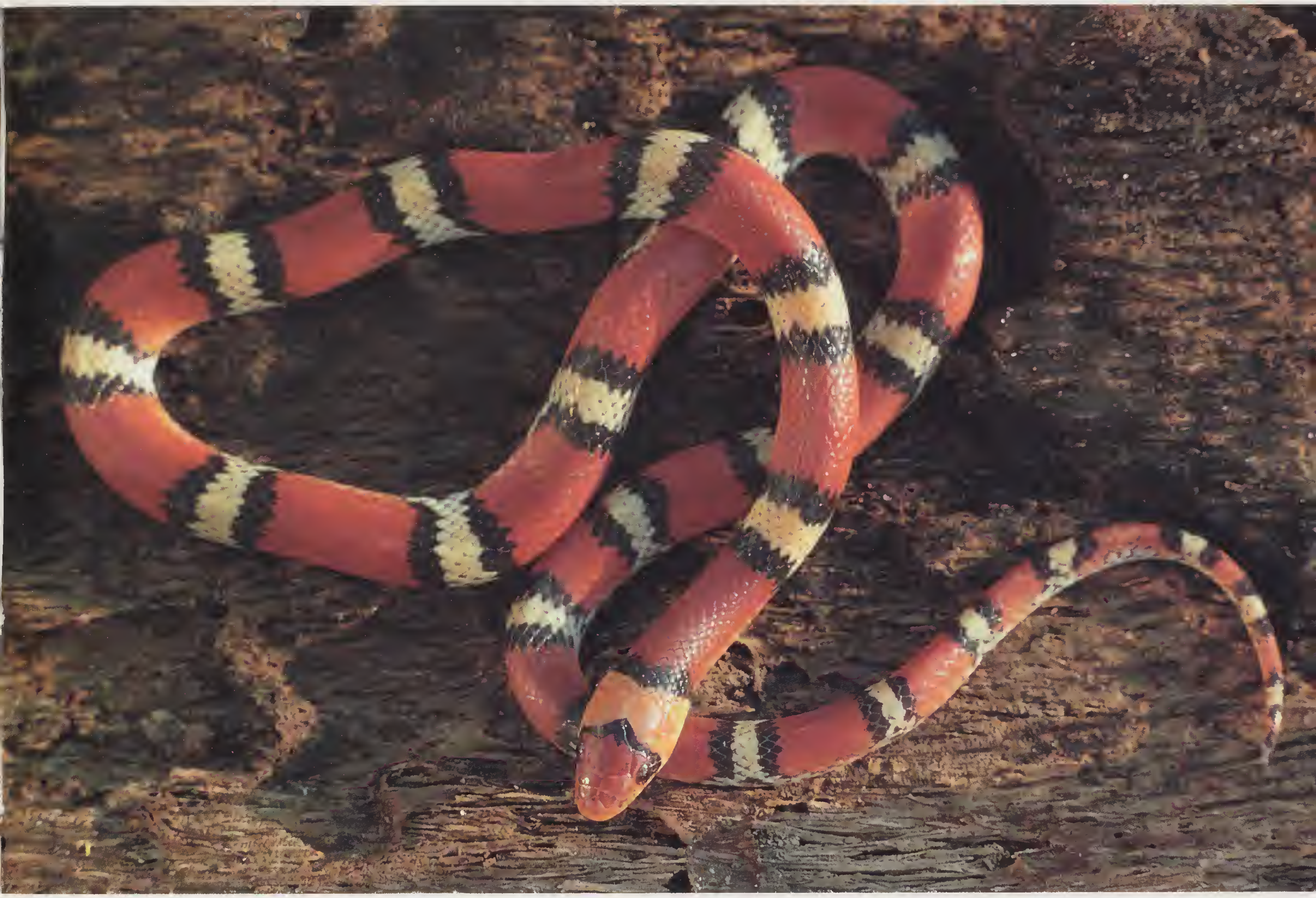


The harmless scarlet king snake, above, resembles the deadly coral snake, left. But which is the model and which the mimic?

ators. Over time, their mimics evolve the same or similar warning colors and patterns that serve to fool predators. The system works when a predator has a bad experience with a model, learns that it is noxious, and generalizes to avoid any prey that look similar.

In this system, the mimic gains and the predator loses. Models also lose because predators must learn to associate a model's colors with its noxious nature. The more good-tasting, harmless Batesian mimics there are, the greater the chance that naive predators will taste a mimic first, learn that prey with that color pattern are delicious, and start gobbling everything that looks similar. This is why Batesian mimicry works best when the model population is larger than the mimic population.

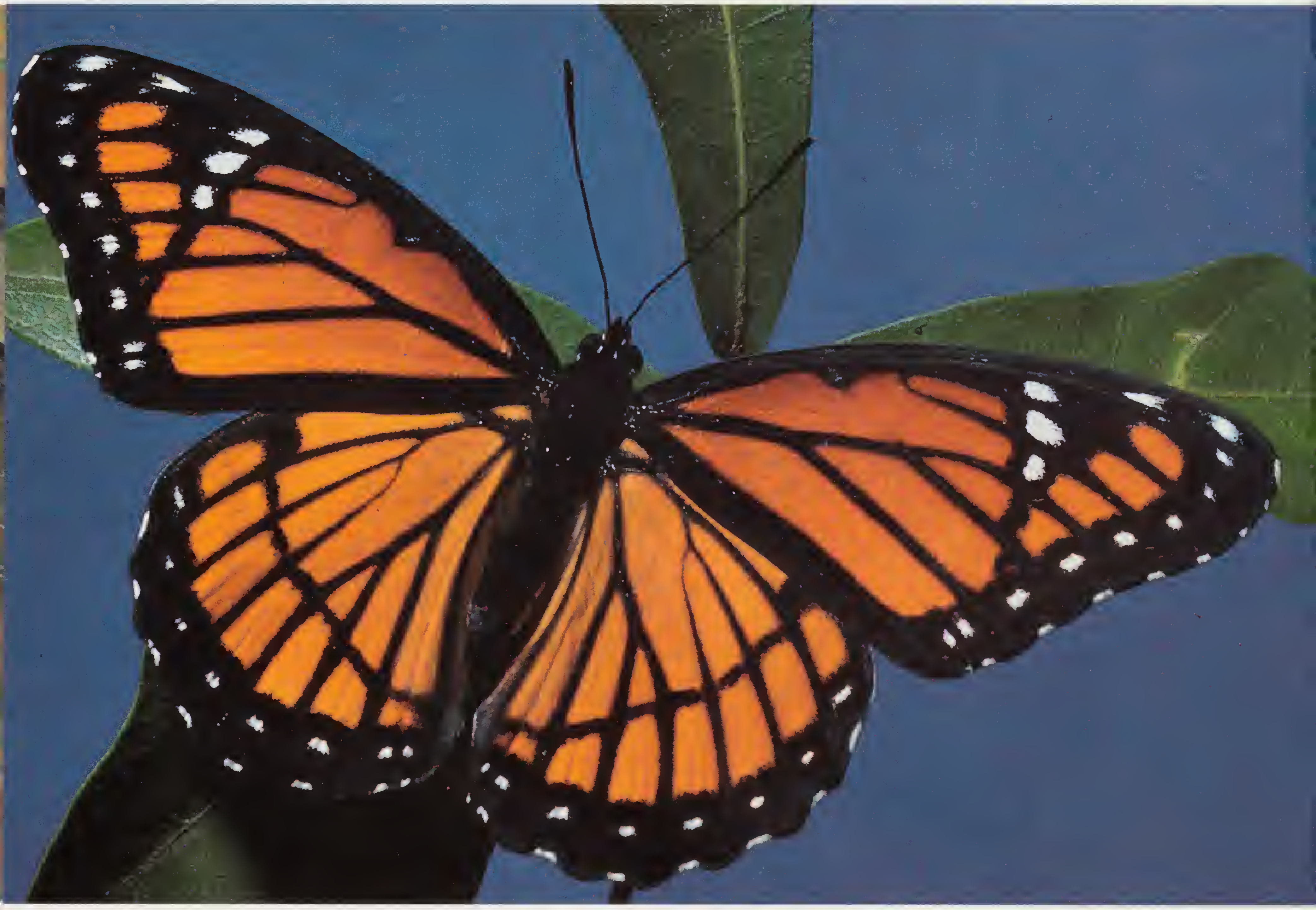
A second form of evasive mimicry is called Müllerian mimicry. Here two or more species, each of which is noxious, look alike. Since each is noxious, it is meaningless to say which is model and which is mimic. Every species involved benefits. The predator gains because it has to learn only one warning pattern and therefore wastes less time attacking harmful prey. The model/mimics also gain: if two noxious species converge on a single warning color pattern, then each individual in each population roughly halves its chances of being tasted.

The third form of evasive mimicry, Mertensian mimicry, is rare and controversial. Mertensian mimicry has been described for only one set of species in the world, a group of primarily neotropical snakes which includes members of two families: true coral snakes, family Elapidae, and several similarly patterned members of the family Colubridae. Members of this species complex have striking ringed patterns, usually of red, yellow (or white), and black.

Controversy about the colorations within this species complex stems from two points: first, do the snakes' patterns involve mimicry at all, and second, if there is mimicry, what type? Some scientists have postulated that the ringed patterns arose simply by chance. Others claim that the rings serve to break up the snakes' outlines against their natural background of leaves. Some of the strongest evidence that the patterns are a form of mimicry is the geographical pattern of color variation in the species involved. Throughout Central America, for example, coral snakes show striking local variation in pattern, yet they typically are matched by local colubrids.

Hence the coral snake species complex apparently does involve evasive mimicry. But what kind? Coral snakes

J. H. Robinson©



Batesian mimicry at work: the good-tasting viceroy, above, mimics the bitter-tasting monarch, right.

have extremely powerful venom. By contrast, the similar-appearing colubrids are either mildly venomous or have no venom. Early interpretations were simple: coral snakes, whose venom was potent, were the models, while the mildly venomous colubrids were Müllerian mimics and the nonvenomous colubrids were Batesian mimics.

There was, however, a catch. Most explanations of evasive mimicry claim it works only when a predator learns that a model is noxious and then generalizes to avoid everything that looks like the model. If this contention is true, could coral snakes really serve as models? Consider a naive predatory bird encountering its first coral snake. Two possibilities exist. The young predator may succeed in catching and killing the snake, thereby learning that coral snakes taste fine and generalizing to search for and eat similar snakes, until the second possibility occurs: the young predator gets overconfident, and the coral snake bites before the predator can kill. Here is the bad experience necessary for predator learning and generalization—but a dead predator can't generalize to avoid anything.

Wolfgang Wickler of the Max Planck Institute for Behavioral Physiology in Germany pointed this out in 1968. At that time there was no evidence that any predator could recognize a coral snake innately, and Wickler felt that coral snakes are simply too lethal to serve as models in a conventional mimicry system. Instead, he proposed that the mildly venomous colubrids, with which a predator could have a bad experience and survive, are the real models, while the deadly coral snakes are actually the mimics. He termed this proposed relationship Mertensian mimicry.

Lincoln P. Brower

> *"Adult birds in the field tend to avoid brightly colored prey."*

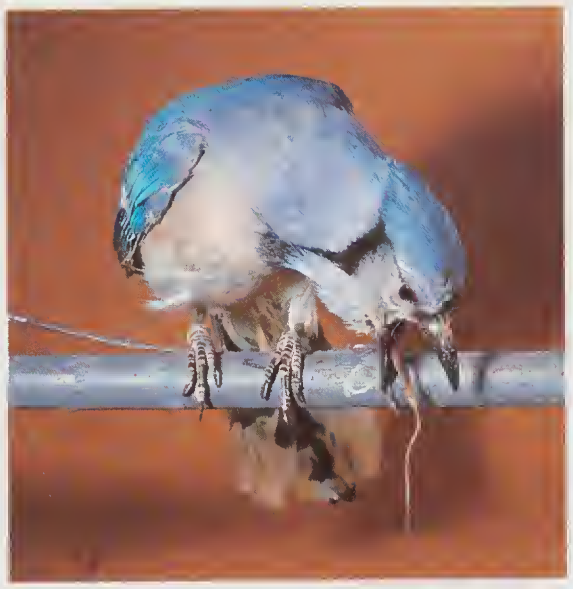
J. H. Robinson©

Below: a blue jay becomes ill after eating a monarch. In the future, the jay probably will avoid all orange butterflies, whether harmful or not.

The predators most commonly involved in mimicry systems are wild birds. It has been well documented that adult birds tend to avoid brightly colored prey. Most texts state they must learn to do this. But is it that simple?

Certainly learning is important in many cases. Jane and Lincoln Brower have shown that starlings and blue jays must learn to avoid bad-tasting brightly colored insects like monarch butterflies. And young red-winged blackbirds attack their first brightly colored stinkbugs, which are noxious, just as readily as they do their first mealworms, a gourmet delight for any insect-eating bird.

But do avoidance responses have to be learned? Two other hypotheses have been proposed. One is that young birds possess a genetically based aversion to anything new, so that novelty itself may be the basis for prey rejection. Recently, however, some experiments I performed indicated otherwise. I hand-reared blue jays, house sparrows and red-winged blackbirds. Every one of my young birds attacked the first brightly colored and contrasting pattern it saw with no hesitation. This does not mean that novelty has no effect on a young bird's prey-attack behavior. Young domestic chicks learn to reject novel stimuli more rapidly than familiar ones. Still, inborn rejection of novelty alone is insufficient to explain why wild birds reject brightly colored prey.



Lincoln P. Brower

The other hypothesis is that birds possess some innate mechanism for recognizing noxious prey. There is a considerable amount of evidence for this idea. For example, a red-throated bee-eater can eat a bee safely by beating it against a branch, then quickly shifting its grip and wiping the bee's abdomen against the perch, thereby de-stinging it. What is interesting is that naive bee-eaters can perform these movements successfully with the first bee they encounter.

A recent study done in England by N. B. Davies and R. E. Green of Edward Grey Institute shows that at least

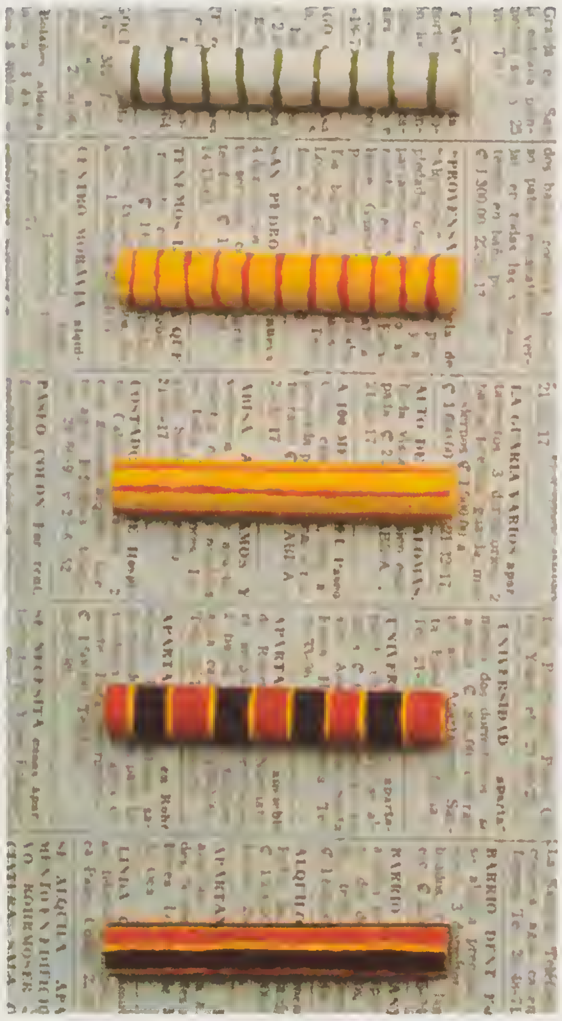
Russ Kinne© (Photo Researchers, Inc.) Our thanks to W. R. Thurston for his generous gift.

one insect eater, the European reed warbler, has a fascinating inborn response to bees and wasps. In this instance a Batesian mimicry system is at work: yellow-and-black bees and wasps, which sting, are models, and harmless hover flies, whose yellow-and-black ring pattern strongly resembles the bees and wasps, are mimics. Amazingly enough, inexperienced hand-reared young reed warblers recognized and rejected the first wasp they ever saw—yet immediately attacked and ate their first hover fly. Predators with such a precise inborn mechanism do not have to learn to avoid bees and wasps.

But could predators recognize coral snakes innately? No one knew. So when I was living in Costa Rica a few years ago, I took the opportunity to hand-rear two potential predators to investigate this question.

> *". . . when they were shown a model painted yellow with red rings, they all flew up to the opposite corner . . ."*

Great kiskadees were alarmed by the coral snake model, below, second from bottom.



Susan M. Smith

The first species I studied was the turquoise-browed motmot. From their nest burrows I removed four broods, two before the nestlings' eyes had opened, and hand-reared them until they could catch their own prey. Then I presented my nine motmots with snake models—wooden dowels painted with various colors and patterns. All of the birds attacked solid red, yellow, green, or blue models with no hesitation. However, when they were shown a model painted yellow with red rings, they all flew up to the opposite corner of the cage and gave alarm calls. They readily attacked a yellow model with red stripes, and a green model with blue rings, therefore the motmots were not afraid of rings per se nor simply the combination of yellow and red. But when the yellow and red were in a ring pattern similar to the venomous snake they always rejected it. I interpreted this as inborn rejection of a generalized coral snake pattern.

Next I hand-reared some great kiskadees which were good test subjects because their broad range, from Texas to southern South America, largely overlaps that of the coral snake species complex. The kiskadees behaved just like the motmots. All nine birds readily attacked plain models of red, yellow, black, white, or green. To test for novelty rejection, the first pattern they received was white with dark green rings. All attacked it with no hesitation. Next they were shown the yellow-and-red ring model—all rejected it, yet attacked the yellow-and-red striped one. Last came my masterpiece: a wooden dowel carefully painted with red, yellow, and black rings. Here the response was fascinating. The kiskadees clearly had a stronger aversion for the coral snake pattern than for the yellow-and-red ring pattern. More birds gave alarm calls to the coral snake rings, and the calls were of higher intensity.

This leads us to question the existence of Mertensian mimicry, which is based on the premise that predators must learn to avoid coral snake ring patterns. We now know that at least two avian predators do it innately.

Thus recognition can be inborn. But what about generalization? Generalization by predators is crucial to the functioning of evasive mimicry. If predators didn't generalize to avoid things that resemble the model, mimics would gain no advantage and the whole system would break down. The young reed warblers were able to recognize wasps and bees innately, and this knowledge was so precise that the young birds were not fooled by the hover flies' resemblance. Hence the models were safe, the predators were not duped out of a meal, and the mimics got eaten—not how a well-run mimicry system should operate.

The motmots and kiskadees I tested had an inborn recognition of coral snake patterns. In addition, the birds showed strong evidence of generalization since they rejected the yellow-and-red ring pattern which only vaguely resembled a coral snake. Why should they do this? Probably because of the high variability in color patterns of coral snakes, i.e., there is no single color pattern possessed by all lethal snakes. In dealing with something so deadly, mistakes can be fatal, so inborn generalization, along with inborn recognition, is a real advantage to the would-be snake eaters.

Since two out of two avian predators tested showed both innate recognition and innate generalization of coral snake patterns, there may be no need to invoke Mertensian mimicry at all. The coral snake mimicry complex can be explained in terms of Batesian and Müllerian mimicry.

Not all bird species acquire their aversions to warning-colored prey in the same ways. Yet what these aversions are, and how they are acquired, can have a strong effect on the efficiency of local mimicry systems. More careful studies on the behavioral development of young birds of a wide variety of species are needed before we can really understand how mimicry systems work in nature.

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RESEARCH & REVIEW

Richard E. Bonney, Jr.

Band Stand

A few years ago Nancy Burley obtained 40 zebra finches for a study on parental behavior. She routinely banded them with a variety of colored leg bands and released them into an aviary. Five months later she realized that most birds wearing red or pink bands were breeding, while most of those wearing light-green bands were not. When she replaced the green bands with red ones the rebanded birds began breeding.

Burley was intrigued. The idea that a bird's leg color might influence sexual behavior was novel. Birders know that leg color can be important in field identification, for example, the bright yellow legs of the lesser yellowlegs help distinguish the bird from the green-legged solitary sandpiper. But the idea that leg color could be important to the birds themselves had been suggested by only one researcher, E. H. Burtt, Jr. So Burley, of the University of Illinois, along with Gail Krantzberg and Peter Radman, designed a study to test individual zebra finch sexual preferences for six leg-band colors ("Influence of colour-banding on the conspecific preferences of zebra finches," *Animal Behaviour*, vol. 30, pp. 444–455).

The researchers designed an experimental chamber consisting of a central area and four radiating arms. Each arm contained a caged "stimulus" zebra finch. Three of the stimulus birds were banded, each with a different color. The fourth bird remained unbanded. A fifth "test" bird was released into the central area from which it could see only one stimulus bird at a time. The test and stimulus birds could not touch one another, but could engage in preliminary courtship activities. The researchers measured sexual preferences of test birds as the amount of time they spent courting each stimulus bird. Fifty-eight different birds were tested, 41 males and 17 females, for several hundred hours of observation.

Burley, Krantzberg, and Radman determined that sexual preferences indeed were affected by leg-band color. Certain colors were more attractive, and others less attractive, than the natural, unbanded condition. Preferred colors coincided somewhat with colors occurring naturally in the finches' plumage and beak. Females most preferred males with bands of bright red, the color of the male's beak; males most preferred black, which occurs in several places in the adult plumage. The least preferred colors, light blue and light green, do not occur in the zebra finch's plumage.

Were the test birds reacting to the altered color of the stimulus birds' legs, or would their sexual behavior have been affected by adding color anywhere on the birds' bodies? This study cannot answer this question conclusively. Support for the idea that leg color determined the observed preferences comes from the fact that birds' legs often show color changes that accompany developmental or seasonal changes in plumage. For example, the legs of nestlings or juveniles of many species are black, gray, or tan, while adults have bright yellow, orange or red legs. Also, when males and females of the same species have different colored legs, the male's tend to be brighter. And for several species, such as the snowy egret, leg and foot color intensifies during the breeding season.

But perhaps the birds' sexual preferences would have been altered by other types of colored markers. For example, if a female zebra finch's sexual drive is stimulated by the color of the male's bright red bill, then a red wing tag may be just as attractive as a red leg band.

Either way, the implications of this study are ominous. Thousands of ornithological studies have used color-banded birds in the field and laboratory to permit identification of individual birds. Often such recognition is essential for correct interpretation of data. However, researchers have paid little attention to the effects of color marking on birds' social behavior. Inasmuch as studies using color marking must continue, this subject demands attention.

Using Your Ears

Beginning birders quickly realize that recognizing birds' songs is a tremendous aid to field identification. In fact some species, such as several flycatchers of the *Empidonax* group, can be positively identified only by their songs. But how does one decipher all the whistles, trills, and chips that resound across the landscape?

This spring, help is available from two new sets of bird recordings. The first is the second edition of *A Field Guide to Bird Songs of Eastern North America* (Houghton Mifflin, Boston. 1983. Two 12″ 33⅓ rpm records or 2 cassettes. $19.95/set). As part of the Peterson Field Guide Series, it is designed to complement Roger Tory Peterson's *A Field Guide to the Birds East of the Rockies* and includes songs, calls, or both of 246 species, arranged in the same order as in the book.

The second set is the National Geographic Society's *Guide to Bird Sounds* (National Geographic Society, 17th and M Sts., N.W., Washington, D.C. 20036. 1983. Four 10″ 33⅓ rpm records. Write to the Society for price and ordering information). This includes songs, calls, or both of 179 species, arranged in the same order as the Society's new *Field Guide to the Birds of North America.*

How do the recordings compare?

There are many similarities. This is not surprising, since both sets were produced by the Library of Natural Sounds at the Cornell University Laboratory of Ornithology. Most of the recordings were selected from the Library's extensive collection of bird songs. For both sets, the Library staff chose the best and most typical song or songs of each species.

The quality of the two sets also is comparable; both are excellent. Background noise is negligible and the songs ring out loud and clear. What's more, they really sound like birds in the field.

The major difference between the two sets is the choice of species. The Peterson set is designed as a general reference and presents 246 species, all found in the eastern United States. Most are common, and most families are well represented. For example, 35 warbler species are included.

The National Geographic set is more specialized. It emphasizes elusive songs, such as that of the Bachman's warbler, and confusing songs, such as those of the various flycatchers. It contains 179 species from across the country—about 120 from the East. Of these, 30 are not in the Peterson set, including eight shorebirds and several species that are rare or have limited ranges in North America, such as the common pauraque and the Couch's kingbird. Some families are poorly represented; there are only six warblers. The two sets, therefore, are somewhat complementary, and many birders—especially shorebirders and Texas birders—would benefit from owning both.

The revised Peterson set differs from the first edition in several ways. The new one is of far superior quality: there is less background noise from traffic, wind, and other birds, and the sound reproduction is much more faithful to the natural songs. Omitted from the new edition are species that are heard less commonly than the others, or whose songs are less important in identification. This has given more playing time to the remaining species, and more of their songs, calls, and chip notes are included. For example, the expanded coverage of the tufted titmouse and black-capped chickadee allows the listener to compare their potentially confusing calls. In addition, new species have been added such as the spruce grouse and black rail. Thus, the set is a worthwhile investment for birders who already own the first edition.

Novices should be aware that listening to these recordings will not result in instant learning. They are excellent aids to bird identification, but are only supplemental to time spent in the field. As teachers, records and field guides cannot take the place of instruction from an experienced birder. But they can help.

Seeing Red

Ornithologists have often stated that hummingbirds have an instinctive preference for the color red. They certainly are attracted to red objects: there are reports of hummingbirds hovering about red bandanas, sunburned noses, even red traffic lights. But do the birds really prefer red to other colors? This contention has been challenged by several researchers, including Lucinda A. McDade of Duke University ("Long-tailed hermit hummingbird visits to inflorescence color morphs of *Heliconia irrasa*," *Condor*, vol. 85, pp. 360–364).

McDade conducted a study in Parque Nacional Soberania, Panama, where the broad-leaved herb *Heliconia irrasa* occurs in two color types. One has red bracts, the other has yellow. Bracts are modified leaves; on *Heliconia* they enclose the small flowers and are the most conspicuous part of the plant. Other than color, the two plant types are similar: they are the same height, produce the same number of flowers and amount of nectar each day, and have the same nectar-sugar content. Both types are visited by long-tailed hermit hummingbirds, which feed on the nectar.

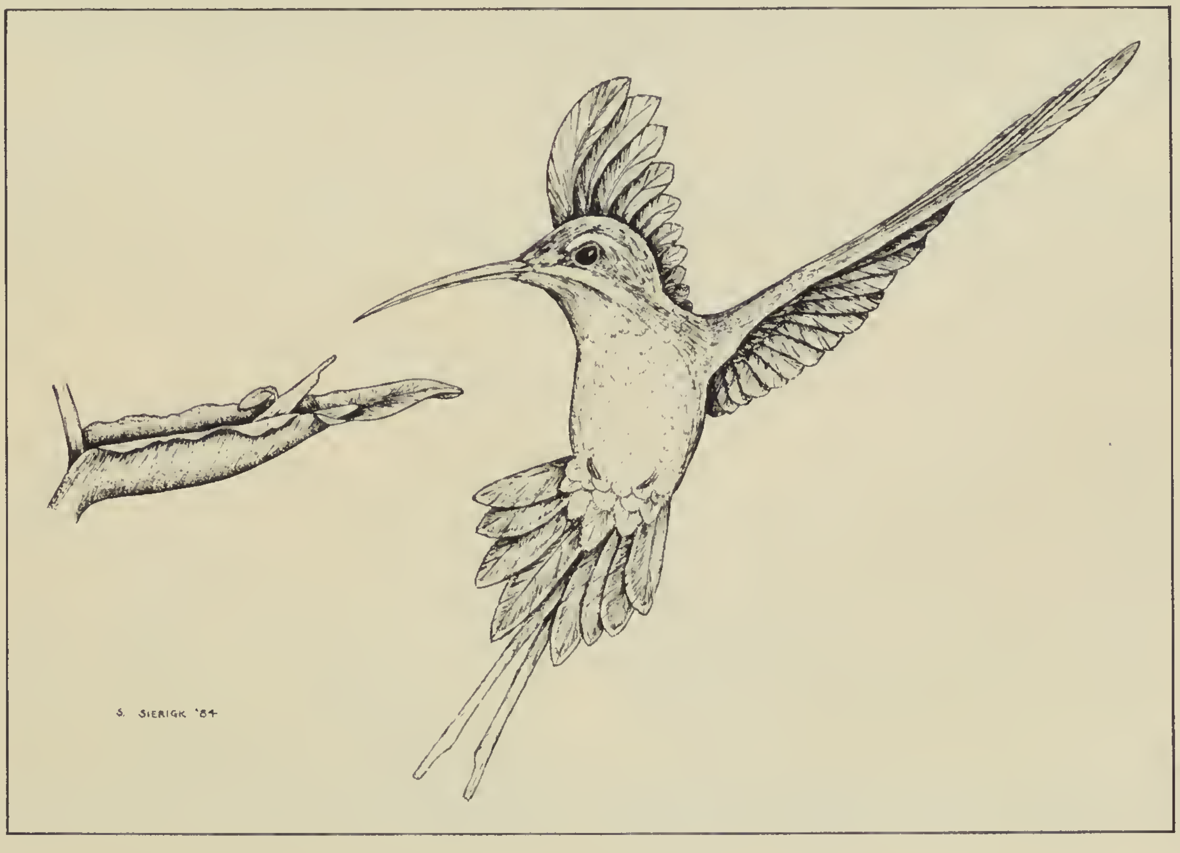
To determine whether these hummingbirds prefer the red plants to the yellow ones, McDade established a study site along a 220-yard stretch of road. After determining the proportion of each color plant growing on the site, she dusted one of the red plants with fluorescent powder. When hummingbirds came to feed on the plant they picked up the powder on their feathers and spread it to other flowers, leaving a record of which flowers they visited.

McDade examined all *Heliconia* plants on the site for evidence of powder during eight days of the peak flowering season. She discovered that the plants had received powder in proportion to their abundance, and concluded that the birds did not visit red plants preferentially to yellow ones.

But does this evidence prove that long-tailed hermit hummingbirds do not prefer red? Not really—McDade had no accurate method of measuring the number of visits to each flower. Therefore, red-bracted flowers may have been visited more often than the study indicated. Nevertheless, McDade has shown that yellow-bracted flowers certainly are not avoided.

It also is possible that the hummingbirds were born with an instinctive preference for the red *Heliconia*, but learned from experience that the yellow variety is just as rewarding. Studies done as early as 1941 have shown that hummingbirds learn to visit colors that provide the greatest energy reward, that is, the most abundant, concentrated nectar.

Thus McDade's study, while not conclusive, lends support to previous studies challenging the notion that hummingbirds are driven by an instinctive and inflexible preference for red flowers. "The emerging overview of hummingbird foraging behavior is complex," she writes, "and involves a variety of discriminatory powers." Indeed, color may be just one of many cues that lead hummingbirds to the most rewarding flowers.



Long-tailed hermit hummingbird and Heliconia irrasa

S. Sierigk

Reclaimed Mines

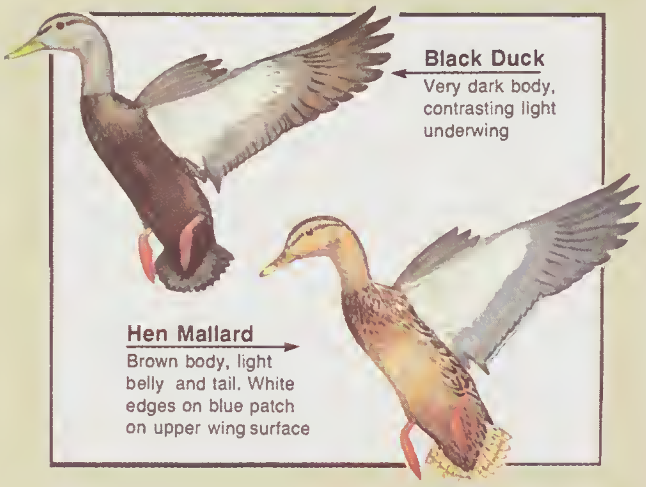
Old strip mines where plants have been reestablished are known as reclaimed mines. In West Virginia, these typically appear as fields of grasses and other herbaceous plants amid tracts of woodland and pastureland. Such clearings add a new type of habitat to the landscape, and attract several ground-dwelling birds. Are these birds breeding successfully in the new habitat? Thomas Wray, II, Kenneth A. Strait, and Robert C. Whitmore of West Virginia University have examined this question ("Reproductive success of grassland sparrows on a reclaimed surface mine in West Virginia," *The Auk*, vol. 99, pp. 157–164).

Working over two breeding seasons, the researchers investigated 185 nests of grasshopper, savannah, vesper, and field sparrows. The study determined that average clutch sizes for all four species were the same as those found by other investigators at other locations. However, predation—predominately by snakes and crows—caused an exceptionally high loss of eggs and nestlings resulting in low reproductive success.

Wray, Strait, and Whitmore concluded that the reclaimed mine represents poor breeding habitat for grassland sparrows; because the grassland is surrounded by forest and pastureland, it harbors a concentration of predators that limits the usefulness of the area as breeding habitat for these birds. The researchers concluded that the sparrow population on the reclaimed mine depends on immigration of sparrows from better habitat elsewhere. They feel that the sparrows continue to attempt breeding in this suboptimal habitat because of site tenacity—the tendency for birds to nest in the same area each season—and the availability of nest sites that appear attractive to the birds. "Although our study site is but a small portion of the total area under concern," they write, "our conclusions may be reasonable for similar reclaimed surface mines in northern West Virginia."

NEWS & NOTES

The U.S. Fish and Wildlife Service is in the process of distributing one million black duck identification leaflets to waterfowl hunters in the eastern flyways in order to reduce the black duck harvest. The black duck population is down 38 percent from the 1960 to 1969 average. Biologists think several factors are causing the decline: eastward expansion of the mallard into black duck range, hybridization of black ducks with mallards, and loss of habitat. Biologists trying to halt the decline agree that teaching hunters to identify the black duck so that they may abide by the new hunting restrictions is the first step and must be taken now. Free leaflets are available from state hunting license vendors and wildlife agencies or by writing: Publications, U.S. Fish and Wildlife Service, Washington, D.C. 20240.


Black Duck
Very dark body, contrasting light underwing
Hen Mallard
Brown body, light belly and tail. White edges on blue patch on upper wing surface

1983 Annual Reports from the Laboratory have been mailed to our members. If you haven't received your free copy write: Membership Dept., Laboratory of Ornithology, Sapsucker Woods, Ithaca, New York 14850.

An intensive effort is under way to track the movements of 30,000 Canada geese in the Atlantic Flyway. The results may reveal why the geese are remaining north of their traditional wintering grounds in North and South Carolina. The geese will be marked with yellow collars stamped with a black letter-number code. If you observe a yellow-collared goose, send a report of the sighting to Richard Malecki, New York Cooperative Wildlife Research Unit, Fernow Hall, Cornell University, Ithaca, New York 14853. Your report must include the band's color and code; name, address, and phone number of the observer; date, time, and location of the sighting; an estimate of the banded bird's flock size, and the habitat the bird occupied, for example, lake, cut cornfield.

The Laboratory Library is offering to members *Management of North Central and Northeastern Forests for Nongame Birds* for the special price of $1. The volume is a collection of 26 papers on bird communities, habitat, wildlife, forests, and silviculture. Soft cover, 268 pages. Send $1 to Library, Laboratory of Ornithology, Cornell University, Sapsucker Woods, Ithaca, New York 14850.

Between 200 and 300 bald eagles were killed over the past three years on or near the Karl Mundt National Wildlife Refuge in South Dakota. The carcasses supply bones, beaks, talons, and feathers for black market trade in Native American artifacts. Bald eagle parts are used to manufacture "authentic" reproductions of Indian headdresses, jewelry, fans, and other ornaments, and are sold in North America and Europe.

U.S. Fish and Wildlife special agents have been investigating the killings and are prepared to charge as many as 50 individuals for killing federally protected birds. Bald eagles are protected by the Endangered Species Act (penalty one year imprisonment and/or $20,000 fine), Bald Eagle Protection Act (one year imprisonment and/or a $5,000 fine), and the Migratory Bird Treaty Act (two year imprisonment and/or $2,000 fine).

Piping plovers are declining in numbers throughout their range. The reason: rapid development is destroying the sandy beaches on which they nest. Because only about 1,500 piping plovers remain on the east coast, they are being considered for Federal Endangered Species listing. In Maine, there are about 20 pairs. The Maine Audubon Society would like to know if you see piping plovers, particularly breeding or exhibiting breeding behavior. Please write to: Maine Audubon Society, Gilsland Farm, 118 U.S. Rt. 1, Falmouth, Maine 04105.

Dear Member:

Besides an interest in the scientific study of birds, we humans also have a need to express our affinity for birds through art, literature, and photography. We at the Laboratory wish to encourage these endeavors and to nurture a deeper appreciation for the aesthetic value of birds.

We have a good head start. For many years Ithaca, Cornell, and the Laboratory have been identified with one of America's outstanding bird artists, Louis Agassiz Fuertes, some of whose paintings I have the pleasure of viewing right down the hall from my office. This happy circumstance arose when we received a bequest of Fuertes oil paintings in 1958 from Frederick Brewster. Over the years gifts of other Fuertes art—watercolors, sketches, small sculptures—have been added to the collection.

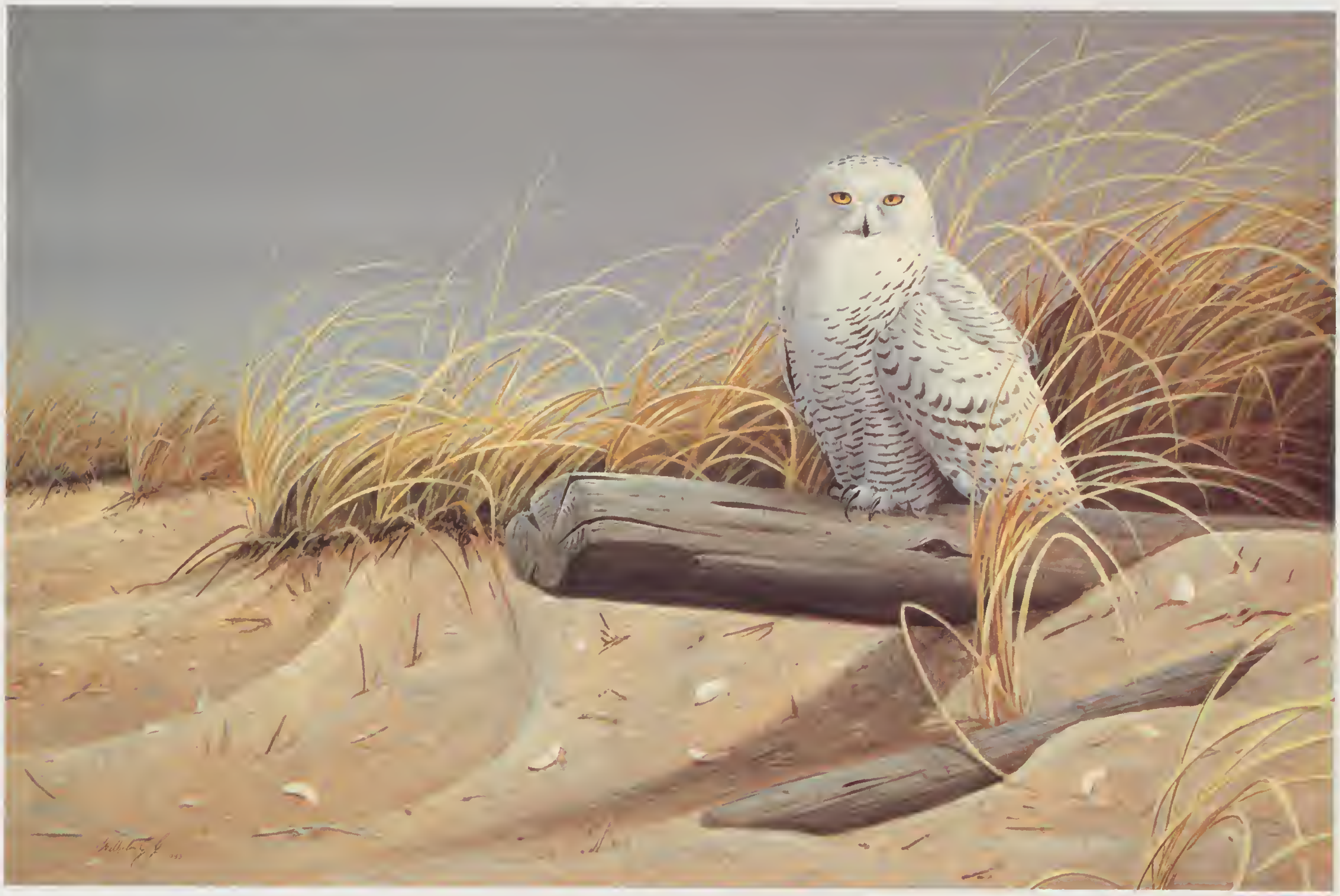
Periodically, each oil painting must be cleaned and refinished by a professional art restorer. We had just about given up hope of finding the money for this project when we received a donation for oil-painting restoration from the "Class of '83" of Cornell's Adult University course in field ornithology. A few months later Fuertes's granddaughter contributed additional funds to begin restoring our watercolors. Thanks to these generous donations, and the continuing help of our members, the next generation of art lovers may fully partake of the color and magic of Fuertes.

In addition to the works of old masters, we show the art of lesser-known artists, some of them exhibiting for the first time. By providing such opportunities we hope to further their careers.

The Quarterly *is another means by which we hope to heighten awareness of the natural beauty of birds. In this issue, artist Wilhelm Goebel—who exhibited at the Laboratory in 1982—brings his own color and magic to our pages. Aleta Karstad has done excellent sketches to illustrate Louise Lawrence's descriptions of downy woodpecker courtship behavior, and Sam Eliot discusses some of the finest bird poems produced by the human intellect. And through the photographs with each story, the birds themselves most eloquently encourage our appreciation of the art and beauty of birds.*

CHARLES WALCOTT, *Executive Director*

"Against the Wind—Snowy Owl," 24" × 36", acrylic.



I Say with My Brush

by Martin Stiles

WHAT THE FUTURE may hold for Wilhelm Goebel, already recognized by those in the know as one of this country's most promising young bird artists, is magnified with tantalizing expectations by the artist's own words:

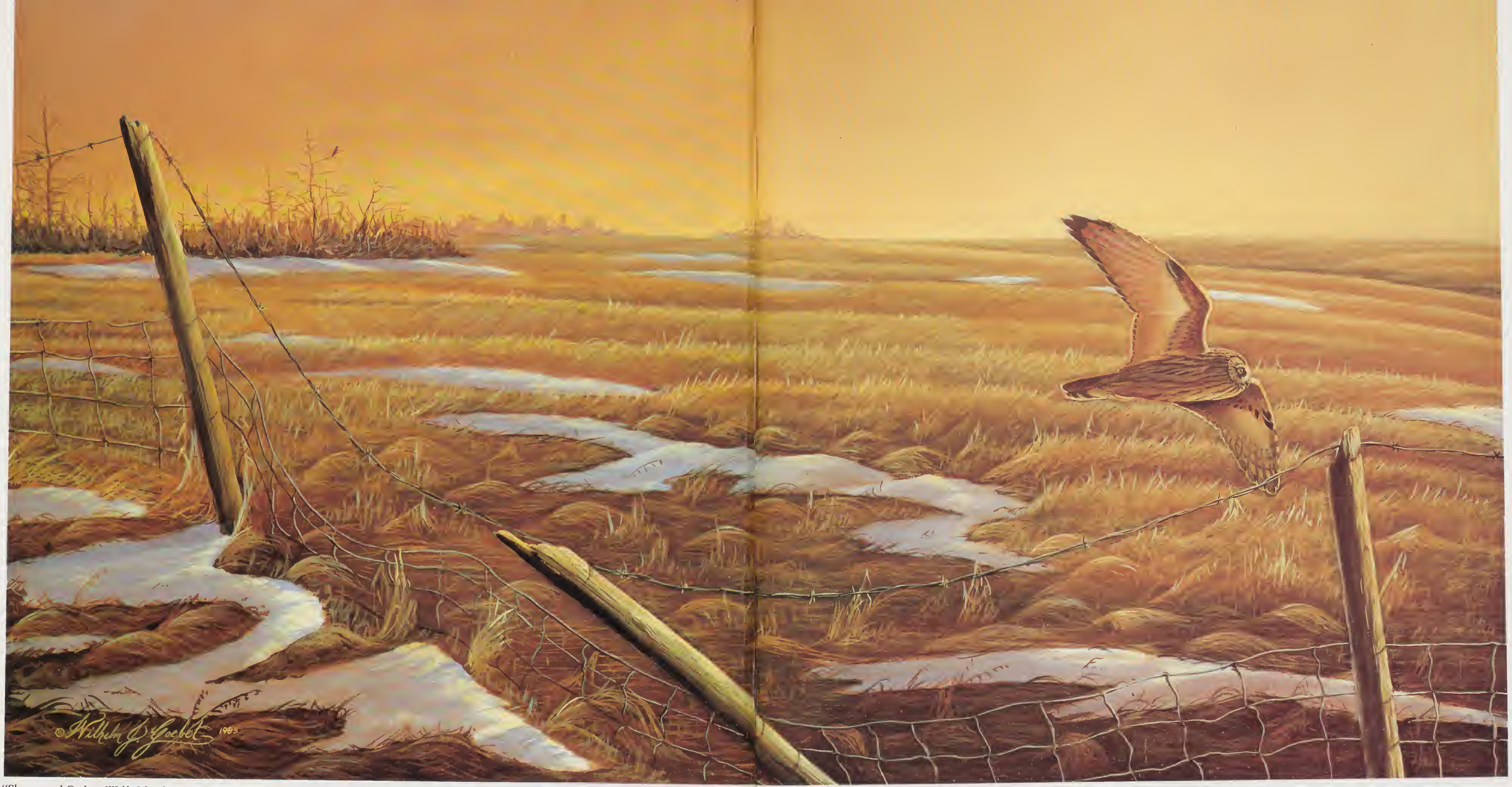
"I see things I can't wait to paint. But I won't do them yet because I know they are beyond my capabilities."

In context with what Goebel has done already at the age of 24, the comment, uttered in his soft but confident tones, reflects the humility and vision so much a part of creativity. Goebel takes neither his vision nor his talents for granted. He says that since graduating from Ithaca College in Ithaca, New York, with a bachelor's degree in biology in 1982, he has devoted eight to 14 hours a day to painting:

"You learn by doing. The whole secret is hard work. I enjoy it because I love it. Sometimes it is frustrating, but I have this drive in me to succeed. If the only way I could paint was with my mouth, I would do it, holding the brush in my teeth."

By some standards Goebel has already succeeded. In 1982 his work "Palm Tanagers" hung alongside the paintings of many of the world's outstanding contemporary artists, at the Leigh Yawkey Woodson Art Museum in Wausau, Wisconsin. His work was accepted for display in the museum's prestigious exhibit, "Contemporary Western World's Finest Bird Art," by a panel of judges including Dean Amadon, curator emeritus of birds for the American Museum of Natural History. Among the artists on display were: Canadians Robert Bateman (1982 Master Wildlife Artist) and J. Fenwick Lansdowne; Americans Guy Coheleach, George Miksch Sutton, and Owen Gromme (1976 Master Wildlife Artist), and Europeans Lars Jonsson and Richard Ward.

Following the Woodson show came a one-man exhibition at the Laboratory of Ornithology at Cornell. How-



"Short-eared Owl on Wolfe Island," 15" × 30", acrylic.

ever, there is little fear of Goebel resting on his laurels.

"The more you learn the more you want to use what you learn. It's a continuous thing. Ten years from now if you look at my work, you'll probably see a big difference. I can see a difference over the past two years already."

During an interview which took place amid 24 of his paintings on display at the Laboratory of Ornithology, he said at one point that it was unfortunate Louis Agassiz Fuertes died at the height of his career, that it was obvious he was on the verge of saying a lot more. (Fuertes died in 1927 at the age of 53.) Goebel discussed the tundra setting in which Fuertes had placed what is now considered a classic painting of a gyrfalcon. A print of the original Fuertes hung on the wall between two of Goebel's works.

"A goal of my career," Goebel said, "is to place birds within their natural environment, which creates a more dramatic composition while also telling the viewer more about the bird and its life."

Goebel dreams of the day he is established and able to paint whatever he wants. "When I am somewhat financially independent, I would like to go to other countries and do things which haven't been done. There are some African birds and South American birds that have been painted only illustratively. I want to catch them in their natural habitat."

He explained that the inspiration for his work comes from field observations. He uses sketches, skins and, at times, photographs to help him capture on canvas and paper what he had glimpsed in his mind's eye.

Right now Goebel's studio is in his parents' home in Somerset, New Jersey. He concentrates on American birds because "that is what the American public wants and knows." His works range from $125 to $1,200 and he now has a gallery in Flemington, New Jersey, that represents him.

Before he can pursue some of his long-range dreams, there is a reputation to build and craftsmanship to hone. He often visits the home of Don Richard Eckelberry, one of the giants of contemporary bird art who has become his mentor. "Eckelberry's criticism and guidance have become a significant part of my artistic evolution."

In 1963, when Goebel was three years old, Eckelberry wrote an article, "Birds in Art and Illustration," which appeared in *The Living Bird*. In it Eckelberry speaks of ideas that seem to be a part of the young artist's very being:

"When the painter looks at nature he confronts a confusion of colors, values, and shapes. His picture is composed through his way of seeing—his individual point of view. And from all this complexity he chooses a few things with which to make a picture that will convey, he trusts, something of the feeling which impelled him to paint. This is rarely fully realized, but it is the carrot which keeps the artist on the path."

BHL

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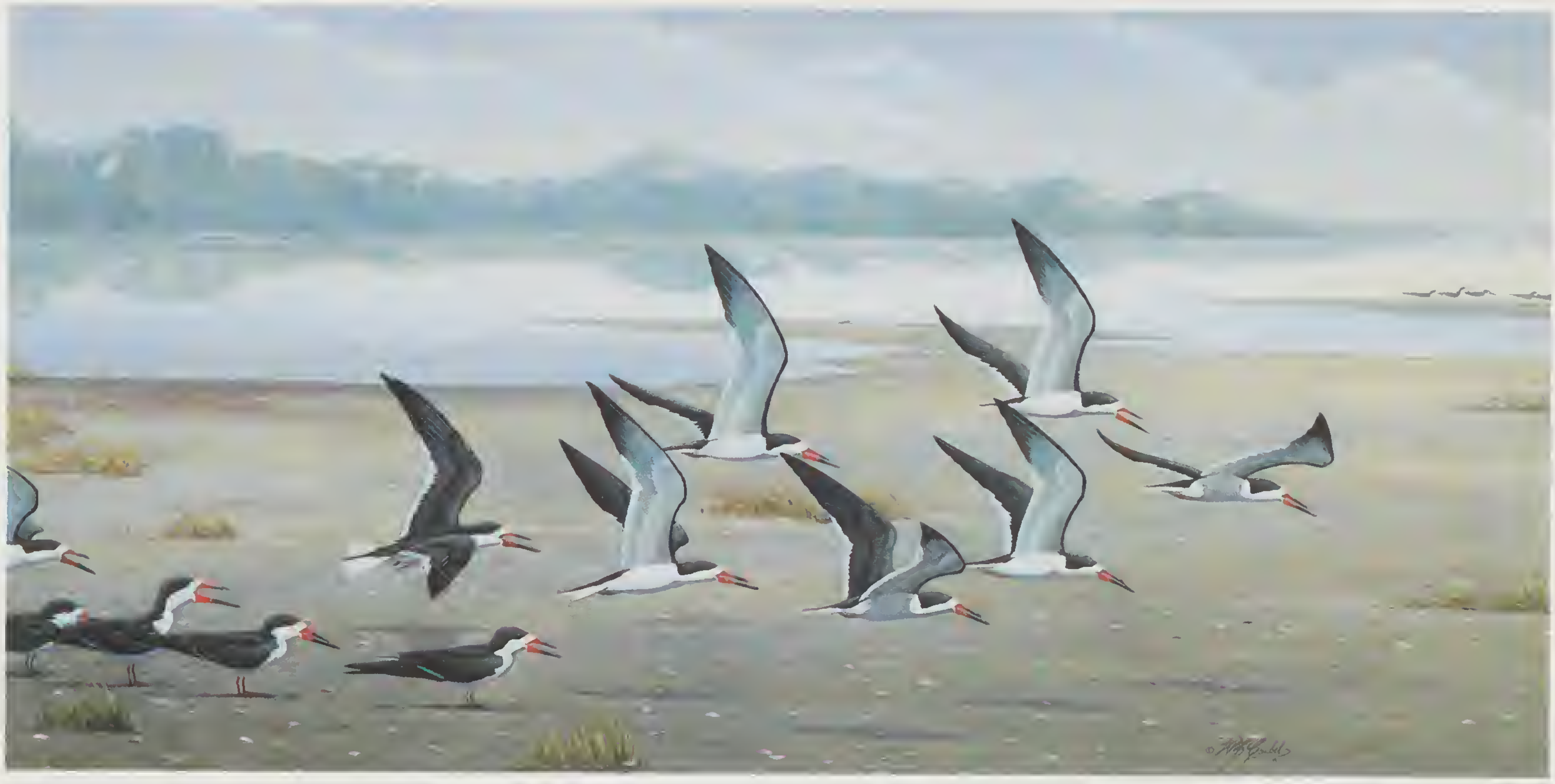

"Skimmers by the Bay," 15" × 30", oil. Right, "Wood Duck in the Shallows," 16" × 20", acrylic.

And, "Craftsmanship is an accomplishment in its own right. It is satisfying to see a thing well executed. There is a sensuous delight in seeing textures perfectly imitated or an object so convincingly reproduced that it seems to really come alive. But it is in the extent to which the artist goes beyond this in his expression and his design of the picture, which determines its aesthetic value."

Goebel said, "I try to use whatever medium will suit my intent. I wanted oil for that [a seascape with skimmers] because it is a looser painting, I didn't worry about detail. I wanted enough time to blend things, the sand, the waves. If I had done it in acrylic I think it would have come out too hard. Acrylic tends to become hard looking, especially for something like this where you are using soft colors. It doesn't blend and smear as well as oil does. I use watercolor, alkyd, acrylic, oil, gouache, whatever I think will suit my purpose."

Although the focus of his artistic life, since he was seven years old, has been to draw and paint birds, the young artist confessed that his first love was drawing Volkswagen cars. "Then I got hooked on birds, how, I can't remember but it's been that way all my life." It is obvious Goebel has not allowed his muse to distract him completely or prevent him from making some practical decisions in planning his career as an artist. He postponed the immersion in painting until after he earned his bachelor of science degree. This gives him the possibility of working as a laboratory technician at least, if his grander plans do not work out, he says.

"Getting started in a field like painting is probably the hardest part. The whole game is getting a reputation, gaining exposure." He said his parents have always been very supportive, adding that he is paying his way at home and buying materials from the commissions and sales that have been fairly regular since he has started painting full time.

> *"When the painter looks at nature, he confronts a confusion of colors, values, and shapes."*

In addition there are extensive field trips, reading and studying to develop a varied and deeper understanding of birds. "But I like to paint other things also. Barns fascinate me, particularly from the inside."

Goebel said he enjoys illustration as well as fine art and would like to do a field guide one day.

"Painting has a great advantage over photography, although there is much magnificent and useful photography. You can paint a particular bird in a particular habitat, which at the same time can be a composite of all that particular species and its living conditions. Art transcends the specific in a way that technology never can.

"This is an illustration," he said, pointing to a watercolor of two grouse, "showing all the feathers, a typical pose, the actual colors on white background. This [the seascape with skimmers] is not an illustration, it's an atmosphere painting. I didn't see each wing feather or the eyes in the birds so I didn't paint them. It's a loose type of painting, more appropriate for oils. Now watercolor is great for rendering detail; it goes on very nicely and dries fast. There are some artists who can do very beautiful detailed work in oil but most illustrative work is done in watercolor."

He talked on about his work interweaving a growing knowledge of his craft with glimpses of his vision, which filled the walls of the gallery and will continue to unfold through the coming years.

The interview ended with a promise when Goebel said: "What I really have to say, I say with my brush."

THE AUTHOR

Martin Stiles is a writer for the Cornell University News Bureau.

In memory of Miss M. L. Coward

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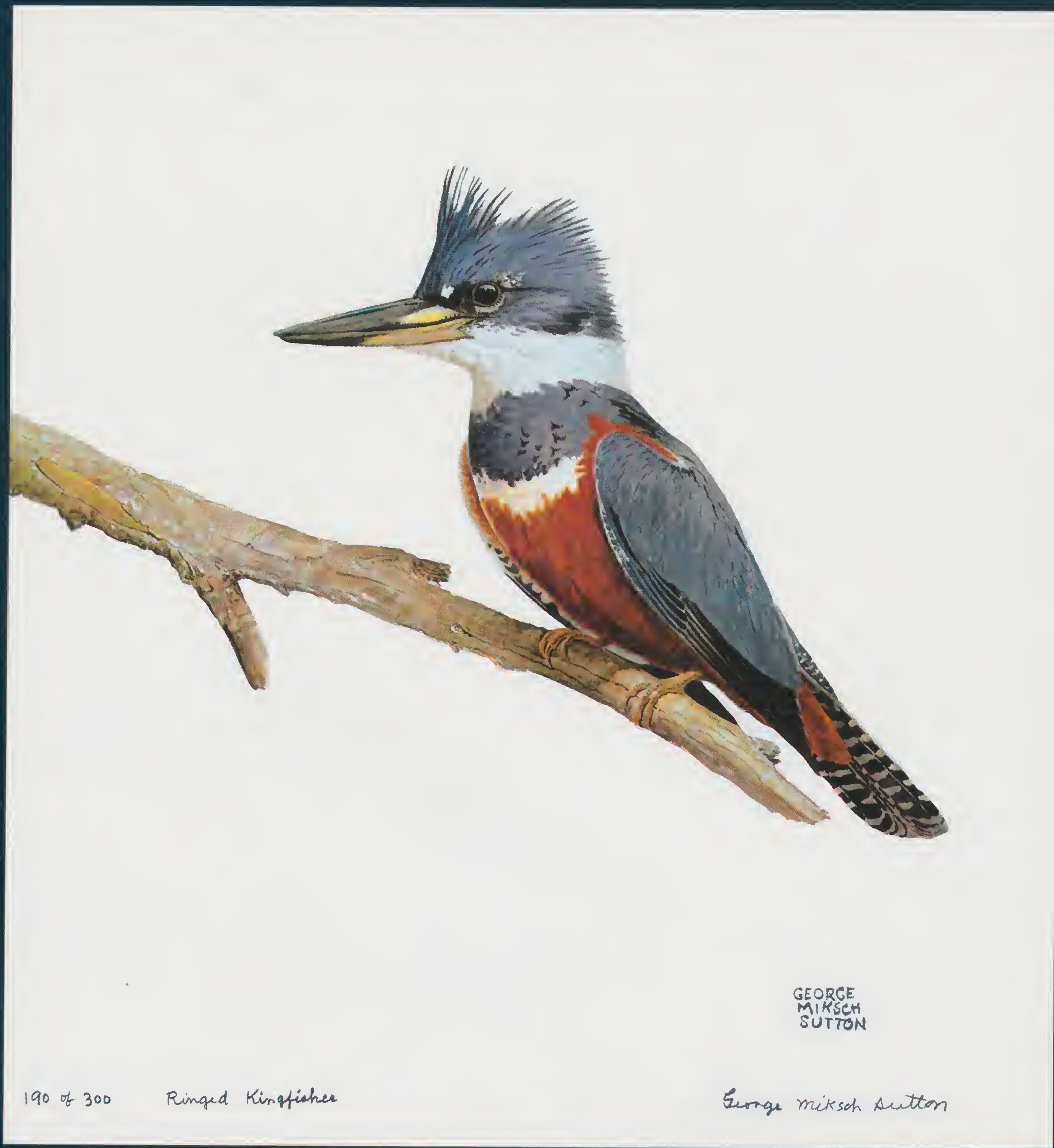
1984

THE LIVING BIRD

Quarterly

Summer 1984

Laboratory of Ornithology
159 Sapsucker Woods Road
Cornell University
Ithaca, New York 14850


GEORGE
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190 of 300
Ringed Kingfisher
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KINGFISHER

by George Mitsch Sutton

This limited edition 22-1/2 × 27-1/2" print of a ringed kingfisher, signed and numbered by Dr. Sutton, is available for a $1,000 contribution to the Cornell University Laboratory of Ornithology. Checks payable to the Laboratory of Ornithology may be sent to: Cornell Laboratory of Ornithology, Sapsucker Woods, Ithaca, New York 14850, Attention: Sutton Fund.

The Cornell Laboratory of Ornithology, dedicated to the study and understanding of birds through research and education, has created the George M. Sutton Fund to endow seminars, art, and colorplates for the Laboratory's publication, The Living Bird Quarterly.

THE LIVING BIRD *Quarterly*

Summer 1984
Volume 3 Number 3

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FRONT COVER. Wilson's phalarope, Alberta, Canada. Photograph by Tim Fitzharris.
BACK COVER. Outside—Bald ibis, South Africa. Photograph by M. P. Kahl. Inside—Osprey by John James Audubon. From *Audubon Society Baby Elephant Folio—Audubon's Birds of America*, published by Abbeville Press, New York. Reproduced by permission.

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4 A Difficult Tightrope Act
Roger Tory Peterson

This year marks the 50th anniversary of the book that revolutionized bird watching. The nation's foremost birder remembers how it all began.

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12 Birders I Have Known
Ben Gelman

Frostbite, injury, poverty—nothing stopped the members of the Sialis Bird Club from trying to keep up with the boys from the Bronx County Bird Club.

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16 Treasure in Argentina
Olin Sewall Pettingill, Jr.

Take a guided tour of the northeastern section of Argentina on the rich Bird Continent, where the caracaras are tame and the flycatchers numerous.

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J. Kent Minichiello

A red-shouldered hawk provides a feast for the eye.

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26 Wetland Sentinels
Donald A. McCrimmon, Jr.

Great blue herons may act as monitors that gauge the health of their wetland habitats. A biologist who has censused heron populations in New York State draws some interesting conclusions based on his findings.

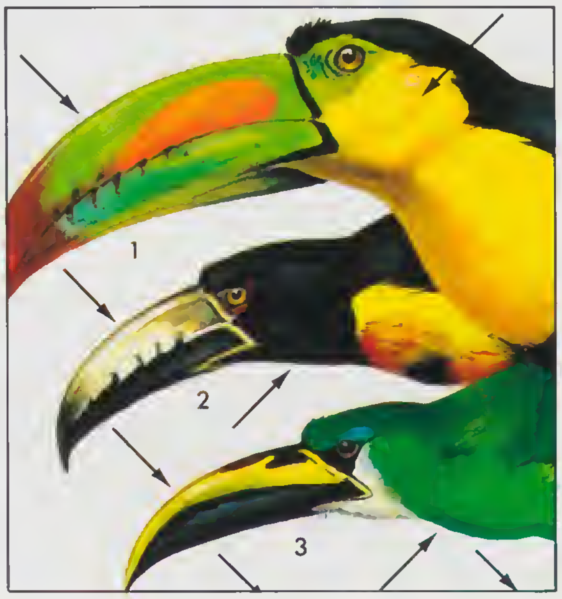
A Difficult Tightrope Act

Roger Tory Peterson

THIS YEAR MARKS the 50th anniversary of my *Field Guide to the Birds* which first saw the light of day in April, 1934. The federal duck stamp that has raised so many millions for the purchase of wetlands also was born in 1934. So was Hawk Mountain, the first of a number of raptor lookouts which were to be established across the land. That same year the National Audubon Society took over *Bird-Lore* from the American Museum of Natural History and transformed the little journal into *Audubon* magazine. Nineteen thirty-four was a vintage year. Although awareness of birds and a passion for bird watching had been in ascendancy since the Audubon movement started a generation earlier, there was a breakthrough in the 1930s.

Today, those who watch birds number from two million to 20-million according to various estimates, depending on how bird watcher is defined. There are various levels of bird watcher, from the armchair ornithologist who reads (but seldom watches), and the chickadee type of bird watcher, all the way to hardcore birders who travel to the ends of the earth to see new species.

Although Alexander Wilson, who published his pioneer work on American birds in 1808, is usually called the "father of American ornithology," his impact was not nearly as great as that of John James Audubon who published his *Birds of America* a few years later. His "Double Elephant Folio" is not exactly a field guide; the heaviest of the four volumes weighs 65 pounds. Even the "Baby Elephant Folio" which my wife, Virginia, and I recently edited weighs 18 pounds.



Audubon's original folio was not arranged systematically; warblers and sparrows were interspersed with birds of prey, waterfowl and sandpipers, but for the first time the majority of the birds of eastern North America and many of the West were adequately portrayed.

To paint these highly delineated portraits and write his text, Audubon required freshly killed specimens, although not as many as he collected. He once implied it was not a good day if he took fewer than 100 birds. He shot like mad but excused his excesses by stating that he was impelled "by the love of science, which offers a convenient excuse for even worse acts." Specimen-tray ornithology prevailed for 75 years after Audubon, for good reason. Initially many birds could not be identified or described with accuracy unless they were in the hand.

In 1872, scarcely 20 years after the death of Audubon, Elliot Coues, an Army surgeon, published his *Key to North American Birds*, a revolutionary guide to the identification of birds in the hand. He wrote to a friend, "I have made my wife test it, in the case of all the birds I have shot here, and without knowing a tarsus from a tail, hardly, she has in every instance given the scientific name of the specimen." Two years later he wrote in his *Manual of Field Ornithology*, "The double-barreled shotgun is your main reliance. Under some circumstances you may trap or snare birds, but such cases are the exception to the rule that you will shoot birds."

In 1903, when Frank M. Chapman published his *Color Key to North American Birds*, illustrated by Chester Reed, the situation was much the same. Chapman wrote: "From the scientific point of view there is but one satisfactory way to identify a bird. A specimen of it should be in hand." Then, aware of an increasing dilemma, he added, "(but) we cannot place a gun in the hands of these thousands of bird lovers we are yearly developing."

In 1906, Chester Reed, the artist, then produced his own little pocket guide, shaped like a fat checkbook, one bird per page, and when I was young that was the book we used, even though it was inadequate (the blue grosbeaks I saw around my hometown were really indigo buntings). Some years later Chapman told me that he and Louis Agassiz Fuertes had planned to do a similar pocket primer but abandoned the idea when Reed scooped them. A pity.

Chapman's *Handbook of Birds of Eastern North America*, first published in 1895, remained the basic reference for any serious birder until the 1930s. It was anything but a primer and it was exasperating if what you wanted was a

Above, toucans from A Field Guide to Mexican Birds *by Roger Tory Peterson and Edward L. Chalif, published by Houghton Mifflin Company, Boston. Copyright © 1973 by Roger Tory Peterson and Edward L. Chalif. Reprinted by permission. Peterson's birding expeditions have taken him to every continent; at left, he scans the Antarctic landscape from the skeleton of a blue whale.*

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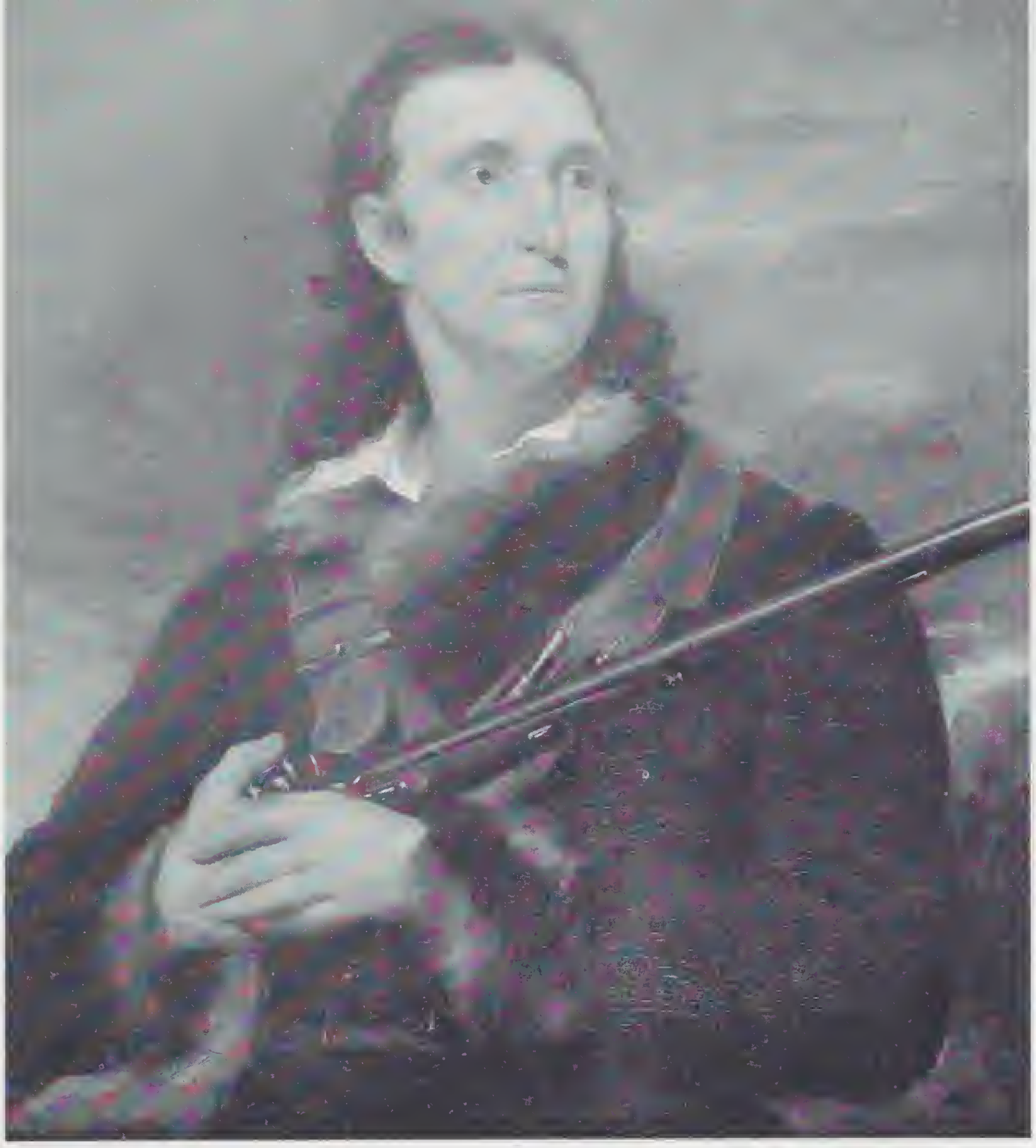
" . . . *we cannot place a gun in the hands of these thousands of bird lovers we are yearly developing.*"



PAINTING OF JOHN JAMES AUDUBON BY JOHN SYME, 1826. WHITE HOUSE COLLECTION.

Audubon, right, used a shotgun to collect specimens needed for his detailed paintings such as the long-billed curlew, far right. Lower right: a plate from Seton's Two Little Savages, *1903. Seton was among the first to draw simple, patternistic bird sketches.*

quick clue to identification. Descriptions were organized systematically from beak to tail. The American robin reads: "Top and sides of head black, a white spot above and below the eye; rest of upperparts grayish slate-color; margins of wings slightly lighter; throat white streaked with black," etc. Not until the end of the description is the diagnostic rufous of the underparts mentioned.

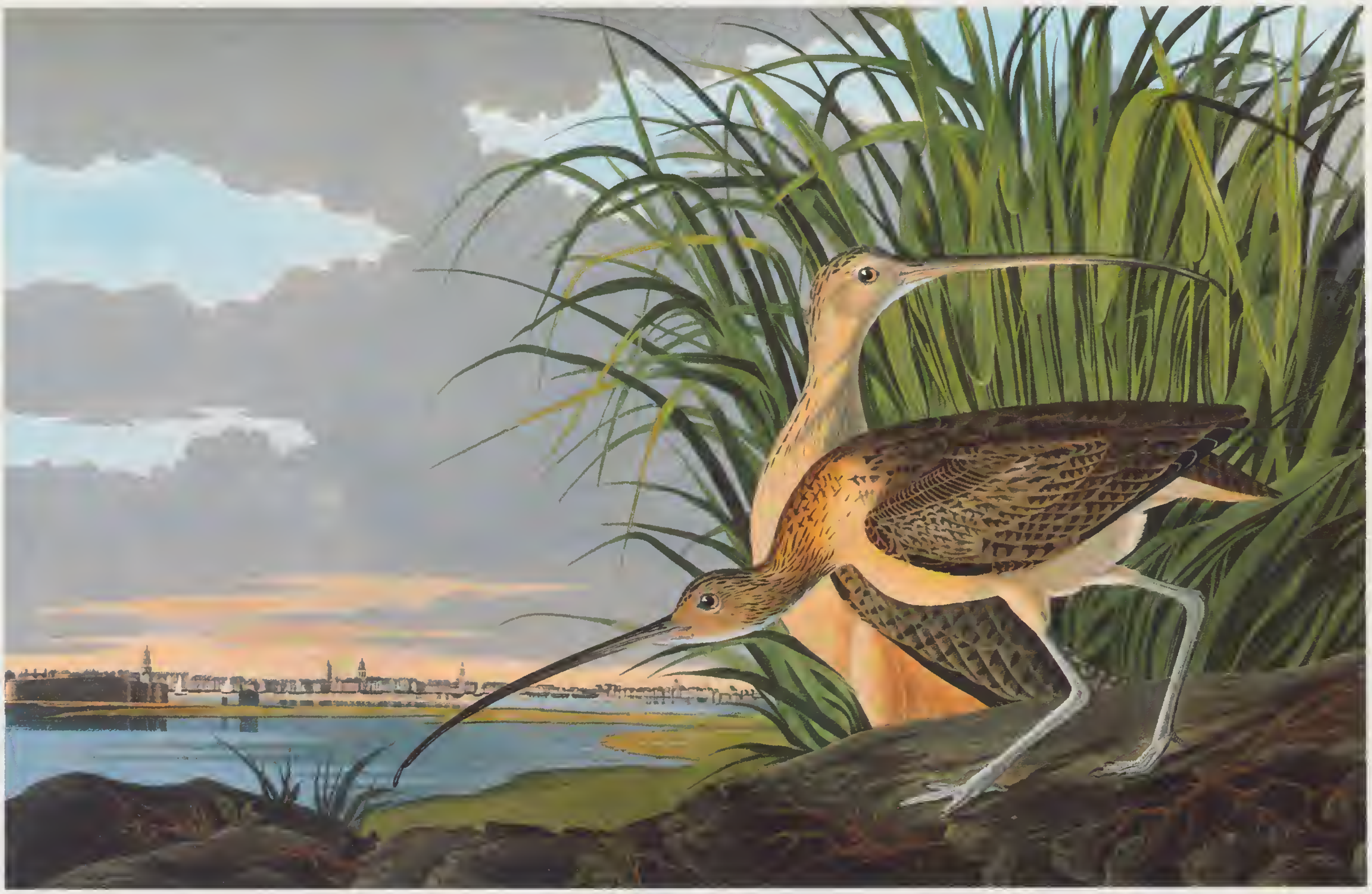
Inevitably, the idea of field marks surfaced. As far as I can determine, the term was first used in 1906 by Ralph Hoffman, a New England schoolmaster, who later moved to California. He wrote two excellent books, *A Guide to the Birds of New England and Eastern New York,* and *Birds of the Pacific States,* which lacked only colorplates to put the concept across in a visual way.

When I was a teenager, one of my favorite books was Ernest Thompson Seton's semi-autobiographical novel *Two Little Savages.* The part that caught my imagination was where the young hero, Yan, sketched some mounted ducks he found in a dusty showcase. He had a book that showed him how to identify ducks in the hand, but since he saw the live birds only at a distance, he was usually at a loss for their names. He noticed that the ducks in the showcase had bold patches or marks that were their labels or uniforms. With pencil and paper he sketched these patterns so that he would know these same ducks when he saw them swimming at a distance.

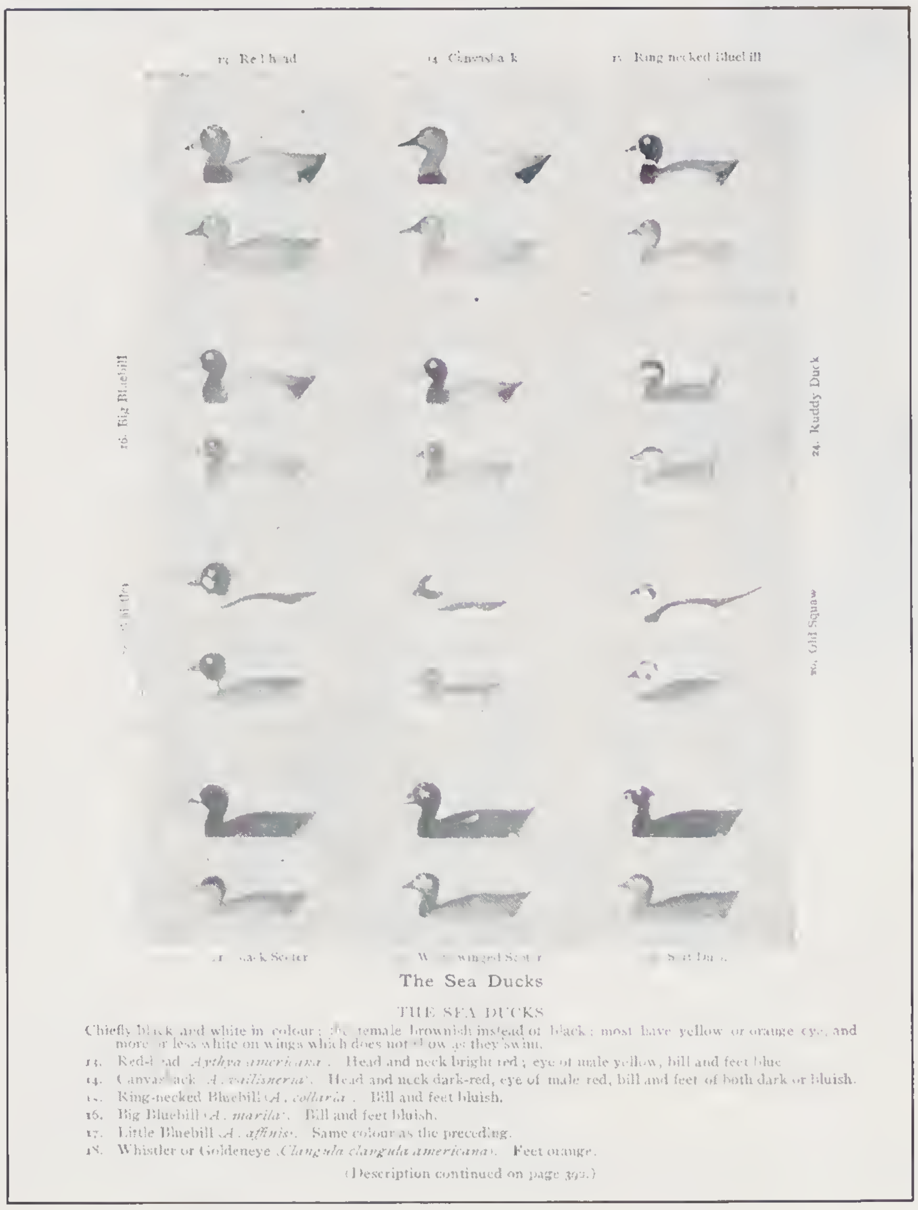
Later, when I was becoming increasingly obsessed with birding, I tried to locate a guide which would treat all birds in this manner. Reed was not the answer, nor was Chapman. Not even Hoffman, although his field descriptions were the best. I wanted a visual boiling down or simplification, so that any bird could be told from all others at a glance or at a distance, but this I could not find.

Enlightenment came when I left my home in Jamestown, New York at the age of 18 to take up my art education in New York City. It was at the American Museum of Natural History that I met Ludlow Griscom, an assistant curator in the bird department. Ludlow, the guru of the field-glass fraternity, was always a good show at the bimonthly meetings of the Linnaean Society, but was a bit austere in keeping a group of young upstarts in line, a half dozen eager beavers known as the Bronx County Bird Club—the B.C.B.C. Such future stars as Joseph Hickey and Allan Cruickshank were charter members. Ludlow's cross-examinations were ruthless when they reported three-toed woodpeckers and other unlikely finds. This was good training and only a few years later both Joe and Cruicky gave similar merciless grillings to other aspiring youngsters at Linnaean meetings.

I became the first non-Bronx member of the very select B.C.B.C. Griscom was our god and his *Birds of the New York City Region* our bible which every one of us could quote, chapter and verse. We used his terminology and even his inflection when we pronounced something as "unprecedented," or a "common summer resident." We learned all about field marks from the master and in turn we became the avant-garde of the birding elite, refining field techniques and setting new standards. It was logical that we should choose Griscom as our role model because he represented the new field ornithology. He bridged the gap between the shotgun ornithologist and the modern birder. He recalled, "When a veteran ornithologist of an older gen-



FROM AUDUBON SOCIETY BABY *ELEPHANT FOLIO*—*AUDUBON'S BIRDS OF AMERICA*, PUBLISHED BY ABBEVILLE PRESS, NEW YORK. REPRODUCED BY PERMISSION.


13. Redhead
14. Canvasback
15. Ring-necked Bluebill
16. Big Bluebill
24. Ruddy Duck
Old Squaw
Black Scoter
White-winged Scoter
Surf Duck

The Sea Ducks

THE SEA DUCKS

Chiefly black and white in colour; the female brownish instead of black; most have yellow or orange eye, and more or less white on wings which does not show as they swim.

13. Red-head (*Aythya americana*). Head and neck bright red; eye of male yellow, bill and feet blue
14. Canvasback (*A. vallisneria*). Head and neck dark-red, eye of male red, bill and feet of both dark or bluish.
15. Ring-necked Bluebill (*A. collaris*). Bill and feet bluish.
16. Big Bluebill (*A. marila*). Bill and feet bluish.
17. Little Bluebill (*A. affinis*). Same colour as the preceding.
18. Whistler or Goldeneye (*Clangula clangula americana*). Feet orange.

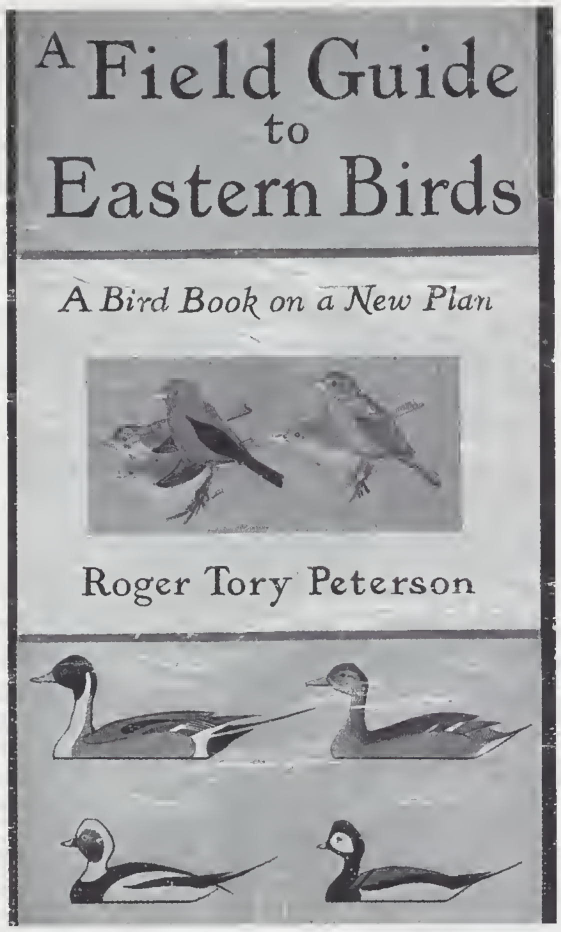
(Description continued on page 392.)

eration wished to add birds to his collection, he drove out on a lovely May day from New York City to Van Cortlandt Park and was perfectly free to shoot as many warblers in the morning as he could skin in the afternoon."

My *Field Guide to the Birds* owes much to Griscom; certainly the philosophy and fine points of field recognition I learned from him, although the visual presentation, particularly the comparative patterns and little arrows pointing to key marks, were my own innovations. Everyone knows the system so well today that it is taken for granted, but it was unbroken ground 50 years ago.

Had it not been for one of the Linnaean members, William Vogt, the book might not have been written. During my art school days Bill was a drama critic and nature columnist for five Westchester County papers. Later he became the first editor of *Audubon*. I met Bill in the late 1920s at a meeting of the Linnaean. On weekends we birded together or with the Bronx County Bird Club. Bill, a better botanist than I, showed me the flowers while I helped him with the birds. It was on one of these Sunday trips, a Christmas

"My schematic drawings were crude, but the concept was valid."

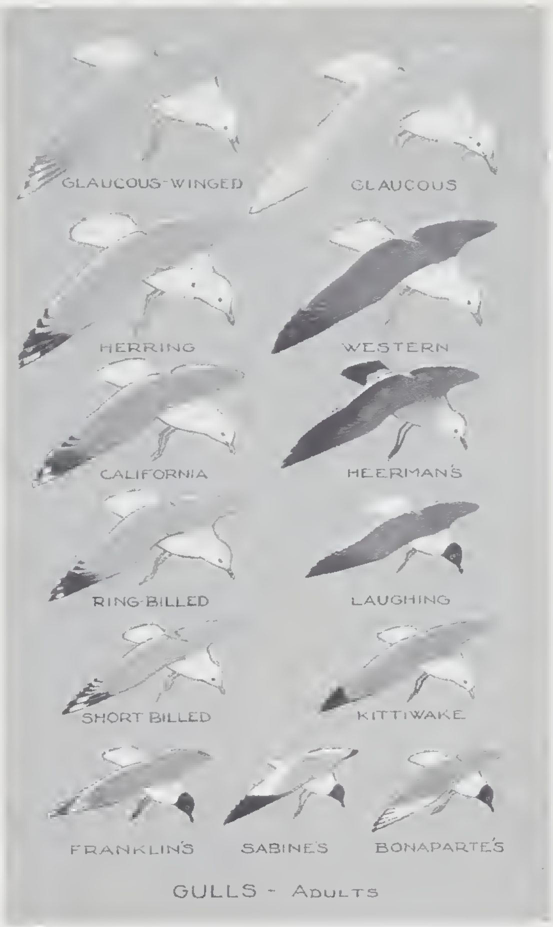


A Field Guide to Eastern Birds

A Bird Book on a New Plan

Roger Tory Peterson

COURTESY ROGER TORY PETERSON



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Right: dummy cover of first field guide, A Field Guide to the Birds, *showing a different title. Far right: plate from first edition of Peterson's* A Field Guide to Western Birds.

bird count on the Hudson near Ossining, that Bill suggested I write a field guide. As he later wrote in *The New York Times:*

"The river was Whistlerian gray, and the outlines of the east and west banks gave us something of the sensation of hanging in space. The few hundred canvasbacks off the end of Croton Point, their reflections in the calm river, were part of the sense of the void. . . . A barely perceptible note fell from a flock of small birds overhead, and my companion said with unchallengeable assurance, 'Siskins!'"

Bill obviously was impressed by my snap judgment, even though I explained that siskins are relatively easy—"they always sound like siskins."

"Roger," he said, "you know these things—the field marks and the voices. Why don't you pass on your knowledge in a book?" He was more excited about the idea than I. As we walked back to the car along the edge of the marsh we developed a plan. The illustrations would be simple and patternistic, rather like those sketches of ducks that Seton had drawn in *Two Little Savages.* The book would concentrate on field marks rather than full descriptions. Voice descriptions would be included if they would help identification. "But," I asked, "how would I get a publisher if I did write it? Nobody knows me."

Vogt guaranteed that he would find a publisher.

Ludlow Griscom already had left the American Museum for a position on the staff of the Museum of Comparative Zoology in Cambridge, Massachusetts, and it was not until I went to Boston in 1931 to teach school that our paths crossed again. It was there that we became close friends, but I dared not tell him about the field guide I was preparing. He was in the hallowed halls of academia, and I was just a teacher who wished to help neophytes.

I missed the B.C.B.C., but enjoyed camaraderie with the young men of the Harvard Bird Club as well as the more staid members of the Nuttall Ornithological Club, the oldest bird club in the country. Our weekend excursions to Newburyport and the outer Cape bolstered my knowledge of the fine points of field identification.

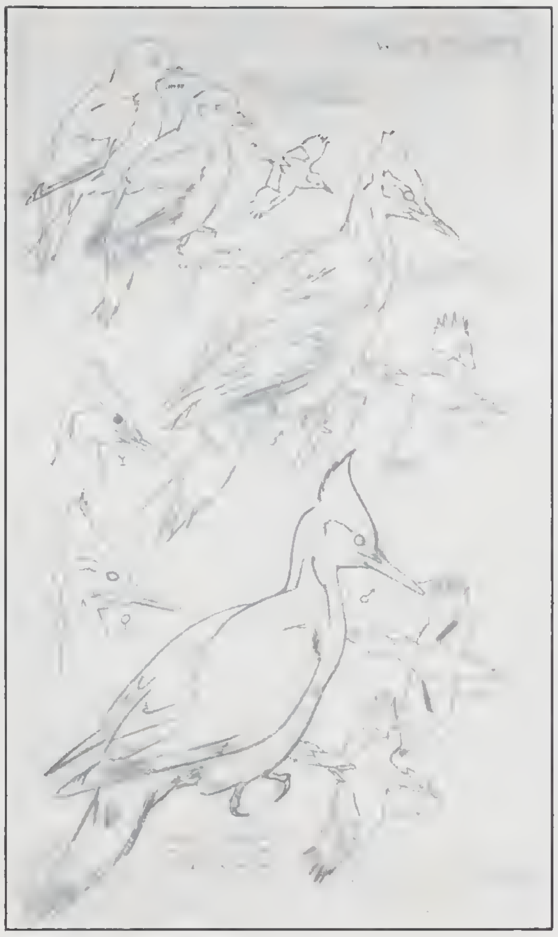
True to his word, Bill Vogt peddled the field guide, still in unfinished form, to four publishers; three in New York, one in Boston. Remember, the year was 1933, the bottom of the Great Depression, when 18-million people were out of work and many more were hungry. Publishers were wary about risking capital on an unknown author. Naive about the facts of publishing, I did not realize that an unsolicited manuscript had less than one chance in a thousand of acceptance.

Vogt's four prospective publishers had rejected my book when I arrived at the office of Francis Allen, a senior editor at Houghton Mifflin in Boston. This dignified gray-haired man, who was chairman of the board of the Massachusetts Audubon Society, was one of the most scholarly amateur ornithologists in New England. When I opened my portfolio, he showed immediate interest. My schematic drawings were crude, but the concept was valid. He wrote in his editorial report: "Peterson's book is conceived on entirely new lines."

One or two members of his editorial committee questioned whether enough people were interested in birds to buy a book with an untried system. To convince them, Allen brought Ludlow Griscom into the boardroom, sat him at the far end of the conference table while he held up one plate after the other. Griscom named every bird without hesitation.

Houghton Mifflin decided to gamble. There would be 2,000 copies of the first printing, and because of the costs my contract read that I was to receive no royalty on the first 1,000. That did not bother me; as a young dedicated teacher I simply wanted to be published.

Publication date was April 24, 1934. Franklin Roosevelt's New Deal was beginning to turn the national economy around, and at that point my own economy took a turn for the better. That first printing was gone almost



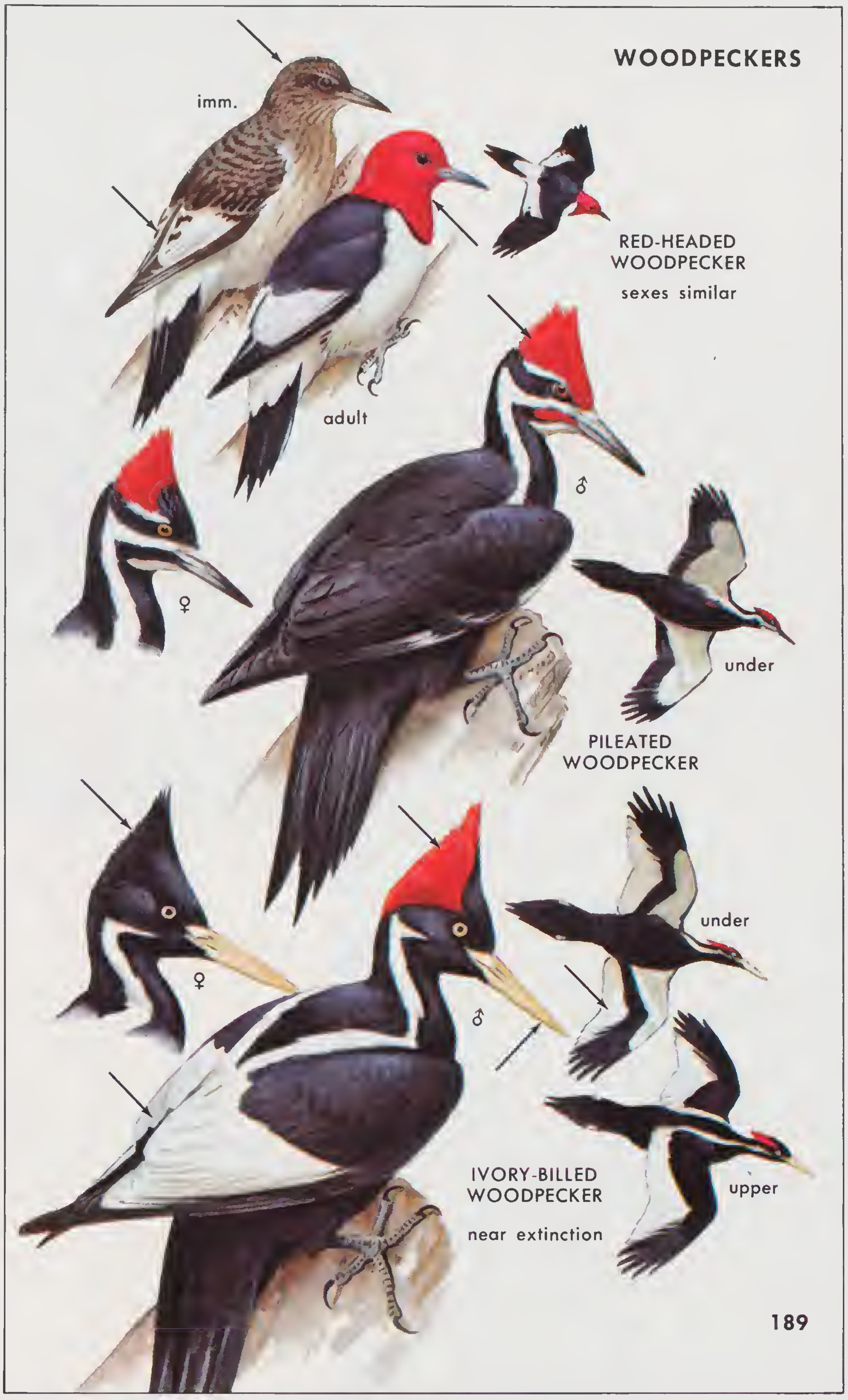
COURTESY ROGER TORY PETERSON

overnight and today a copy in mint condition with its dust jacket (I don't have one) which originally cost $2.75, would bring $1,000 or more in the collector's market.

Lewis Gannett, reviewer on *The New York Times* wrote, "Of all the books published so far this year, the one which will be remembered most 10 years from now is Roger Tory Peterson's *Field Guide to the Birds.*" Fifty years have passed since Gannett made that prophecy and today the yearly sales are more than 10 times that of the first year.

Not all of the reviews were favorable. J. T. Nichols of the American Museum wrote that I had oversimplified immature gulls and shorebirds. And so I had. By reducing their speckled patterns to gray tones, they did not look convincing. I redrew these with more detail in later editions.

In 1939, I added four black-and-white plates to the original book, but it was not until my release from the Army Corps of Engineers in 1945 that I undertook a major revision. Scrapping all the plates, I replaced them with 60 new ones, 36 in color, 24 in black and white. This edition, issued in 1947, was still not the book I would have liked. Although I had suggested that everything be in color, the powers that be insisted they could not afford it. That edition remained virtually unchanged for 33 years. Meanwhile, an update of *A Field Guide to Western Birds* and the prepa-



FROM A *FIELD GUIDE TO THE BIRDS EAST OF THE ROCKIES* BY ROGER TORY PETERSON, PUBLISHED BY HOUGHTON MIFFLIN COMPANY, BOSTON. COPYRIGHT © 1980 BY ROGER TORY PETERSON. REPRINTED BY PERMISSION.

Peterson painted all new plates for the third edition of his field guide to birds east of the Rockies. Above, a finished plate. Left, a preliminary sketch.

Virginia Peterson prepares range maps for a revised edition of the western guide.

ROGER TORY PETERSON

ration of *A Field Guide to the Birds of Britain and Europe, A Field Guide to the Birds of Texas, A Field Guide to Mexican Birds, A Field Guide to Wildflowers* and other publications consumed my time.

Over the years the *Field Guide to the Birds* had built its own following and when Paul Brooks, who was editor in chief, urged me to get going with the long-contemplated fourth edition, he said, "Go the limit!" I was free to repaint every species in color, although there was some merit in keeping the supplementary flight patterns of ducks, hawks, and shorebirds in monotone. I had always felt that about four species per plate would be ideal, inasmuch as the text could be self-contained on the opposite page. By using economy of words, I was able to do this. I may have lost some of my literary style, but contrary to the impression of certain critics, I included more field marks, not fewer. This was because details of range were taken care of by the maps.

Maps were not a new idea; we had used them some years earlier in the European bird guide and also in a number of other books in my field guide series. They are not thumbnail maps in the margins; such maps are too small to show ranges critically and they restrict the amount of text. Our maps are fairly large, show state lines and, as several reviewers pointed out, have set a new standard for field guide maps.

My wife Virginia and I, when researching these maps, could be only as accurate as our sources. We found some states well-documented, others not. Local checklists were helpful and especially the journal *American Birds.* Christmas counts enabled us to define the limits of winter ranges. We also sought the help of key birders in various states, a procedure we are following again in updating *A Field Guide to Western Birds.* Now that many states are becoming involved in atlases, it may be necessary to revise these maps. Inevitably, birds are changing their ranges and so are birders.

After we had researched the maps, Virginia carefully carried out their execution. A research chemist by training, she helped the U.S. Coast Guard Research and Development Center develop its infrared method of detecting oil spills. She also wrote the *Infrared Manual for Oil Spill Identification.* Her critical eye and precise hand were invaluable in the cartography.

I often have been asked why I felt it necessary to undertake such major revisions. It had become evident to me that because of my field guides and the competing Golden Guide by Robbins, Bruun and Zim, as well as other references, birders had become more sophisticated. They demanded more. Furthermore I drew better and I did not want to go to my grave with the earlier editions as my creative legacy. However, in the fourth edition I have leaned more toward portraiture while trying not to lose abstraction—a difficult tightrope act. As an illustrator I was caught between two pressure groups—one wanting even simpler abstraction, the other preferring infinite detail.

A few individuals were so imprinted by the older colorplates through years of use that they preferred them. Although I know that the plates are much improved, there is a tendency for some birders to envisage a bird the way it looks in the book, rather than the way it looks in the field. In preparing the new western book I am endeavoring to look at many species with a fresh eye, as though I had never seen them before.

Space is the final dictator in a field guide. In spite of his pleading with the publisher, the author is allowed just so many pages—that's it! Organizing material so that it fits is like working out a jigsaw puzzle. In a general field guide one cannot devote several pages to a single species, as did P. J. Grant in his manual on gulls which devoted an average of 20 pages per species.

Joe Taylor, former president of the American Birding Association, once said if I were to prepare a book that would please all the hardcore binocular addicts it would run 10,000 pages. Frank Graham, Jr. put it differently. He wrote in *Audubon* that to satisfy their specialized needs would require a set of books equivalent to the collected works of Sir Walter Scott.

To cover all the subtle variations in immature gulls or seasonal variations of shorebirds is the stuff of handbooks—precisely the approach I tried to avoid in my field guides. My intention was to simplify not amplify. Today some of the superstar birders no longer rely on binoculars; they use Questars and other high-powered telescopes which are designed for amateur astronomers and cost astronomical prices. With such equipment they can see even the mites on a merlin. This brings us full cycle to bird-in-hand or specimen-tray ornithology. However, the birds are still alive, free, fun to watch, and a challenge to identify. This is what field birding is all about.

To mark the 50th anniversary of his field guide, an exhibition of paintings by Roger Tory Peterson is on display through this summer at the National Museum of Natural History, Smithsonian Institution, Washington, D.C. Thanks to Smithsonian Institution and Mill Pond Press for their help in obtaining early work of RTP. A catalogue, *Roger Tory Peterson at the Smithsonian,* with more Peterson art is available for $9.95 from Mill Pond Press, Inc., Venice, Florida 33595.

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CAROL STRYKES

Birders I Have Known

Ben Gelman

IT IS MAY 16, 1936—the middle of the Great Depression. Three skinny New York schoolboys have saved part of their lunch money for a week so they can pay the subway, ferry and bus fare from the Bronx to Staten Island to watch birds. They are standing ankle deep in a saltwater swamp near Oakwood Beach, peering through ancient World War I-vintage binoculars at a long-necked bird far out in the swamp.

Is it or is it not a Louisiana heron?

If it is, it would be quite a coup to be able to report it at the next meeting of the Linnaean Society at the American Museum of Natural History.

They had better be sure. Standing in front of the older members of the society, including master inquisitor Dr. Ernst Mayr, and defending a rare bird sighting can be pretty scary for a youngster.

But the trio had been taught well. They check their identification carefully—slate-colored head and back, a touch of reddish brown on the sides, and white underparts. Their record is accepted by the society and it appears in the July-August issue of *Bird-Lore,* predecessor of *Audubon* magazine.

The shortest of the three youngsters in the swamp that far-off May day was Irving Cantor, who still watches birds and compiles at least one New York-area Audubon Christmas Count each year.

The tallest of the trio was William Norse, now a resident of Londonderry, Vermont and regular compiler of the Winhall, Vermont Christmas count.

I was the one in the middle, now living in Carterville, a small community in Southern Illinois near the Crab Orchard National Wildlife Refuge, where I compile an annual Christmas count.

The triumphant triumvirate at Oakwood Beach that day were members of the Sialis Bird Club of the Bronx, patterned after the more famous Bronx County Bird Club, which included the late Allan Cruickshank—noted bird photographer, writer and lecturer for the National Audubon Society; Joseph Hickey—well-known writer on birds, more recently a professor of wildlife ecology at the University of Wisconsin-Madison, and Roger Tory Peterson—dean of bird artists and renowned author of *A Field Guide to the Birds.*

In his 1948 book, *Birds over America,* Peterson tells how he became an honorary member of the Bronx County Bird Club and how he always enjoyed the Christmas counts in the Bronx because of their competitive spirit and the high totals they brought in—usually over 90 and a record 107 in 1935.

In the mid and late 1930s, the Sialis Bird Club members, eight to 10 years younger than the Bronx County boys, were invited to go along on the Christ-

COURTESY THE BETTMANN ARCHIVE INC.

Bronx Park, scene of much birding. Left, Hickey and Cruickshank.

mas counts in the Bronx. I was fortunate to accompany Peterson on one segment of the Bronx count in 1935. My recollection of that day is somewhat dimmed by the intervening 49 years, but a few things stand out in my mind.

One was that, having grown up in upstate New York in a family of Swedish descent, he didn't talk like the rest of us, all natives of Noo Yawk City.

Peterson turned out to be just as quick to call out new species for the list as his reputation had hinted. He already was something of a legend, even though his unique bird guide had been out just a little more than a year.

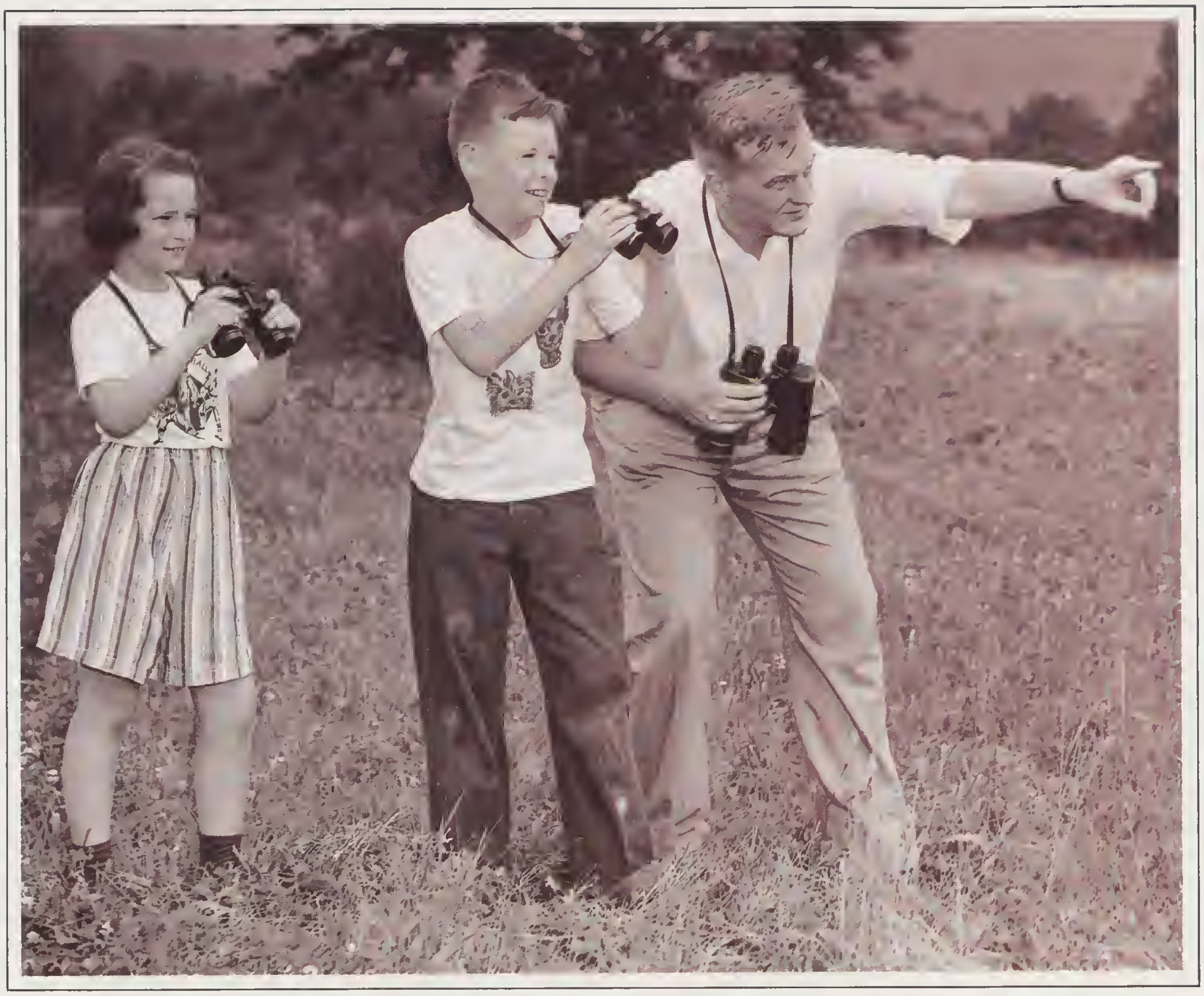
I remember he wore the first pair of Maine hunting shoes I had ever seen—rubber bottoms and leather tops. I had no boots of my own and had borrowed a pair that was a size too small. When I got home that night, one of my big toes was numb and I thought I might have frostbite. But it was just the pressure from the tight boot that had cut off the circulation in that toe and eventually I lost that toenail.

The next few months I walked around in a pair of sneakers, one of which had the front cut out for my sore toe. I even went on bird walks like that, thinking of myself as a martyr to ornithology. And a martyr who had walked behind the great Roger Tory Peterson.

Also around this time there was the incident of the "dovekie." This happened on another Christmas count and Peterson mentions it in *Birds over America* as an instance of how even the experts can be deceived. But he tells only part of the story.

A couple of the Sialis Bird Club boys were somewhat upset with one of their number, the late Danny Lehrman (who grew up to be a noted behavioral psychologist profiled in *The New Yorker*). Danny had an annoying habit of pushing in front on bird walks and trying to be first to sing out a new species for the day's list. So two members of the club decided to cure him. Knowing Danny would be covering Bronx Park during the Christmas count, they carved a wooden model of a dovekie—far more at home out in the Atlantic than in the city—painted it in the winter colors of the little seabird and anchored it in the middle of Lake Agassiz.

As it turned out, Danny missed seeing the little decoy, but Peterson, who had come by in the late afternoon looking for a gadwall, reported that he had seen the "dovekie." There was quite a bit of discussion. The "bird" appeared to be listing to one side but that was attributed to the fact that it was probably worn out after being blown inland. It hardly moved (which was scarcely strange since it was made of wood) but Danny thought he had seen a bit of



HAL H. HARRISON (GRANT HEILMAN PHOTOGRAPHY)

Future wildlife photographer and writer George Harrison and sister Gretchen taking pointers from Roger Tory Peterson, Jones Spring, West Virginia, June, 1949.

movement after Peterson had called his attention to the object.

The upshot was that Danny was allowed to make the announcement of the rare find at the end of the evening's banquet at a German restaurant near Pelham Bay Park where the results traditionally were tallied at the end of each Bronx count. By then, the rest of the gang knew what had happened, and when Danny stood up and made his announcement, we all yelled, "Horsefeathers!" Peterson took the joke in the spirit of good fun. But Danny walked quietly behind the rest of us at our bird outings for the next few months.

On another occasion a few years later I accompanied Allan Cruickshank on a Christmas count. Our starting point, before daylight, was Van Cortlandt Park and Cruickshank's imitative ability brought us the first bird of the day. He whistled up a screech owl along the railroad tracks that ran through the swamp. (A highway now runs through that area.)

> "...he wore the first pair of Maine hunting shoes I had ever seen..."

Here it was, about 5:30 a.m. and bitterly cold as only a damp, windy winter morning can be. A reporter from the now-defunct *Herald Tribune* had been assigned to do a story on the Christmas count. He showed up in his thin street shoes, a skimpy topcoat, a fedora that kept blowing off, with a half-pint flask of whiskey that was supposed to make up for the inadequacy of his other gear. He kept hopping from one foot to the other to keep his circulation going, taking nips from his flask. Long before daylight his flask was empty and he left for his office, but I don't remember seeing any story he had written.

One Saturday night about three years ago, when I still was working as Sunday news editor for *The Southern Illinoisan* and writing a column that occasionally dealt with bird watching, the phone rang and a voice said:

"Hi, this is Joe Hickey, remember me?"

"It's been 40 years since I've heard from you, but of course I remember you. How's the bird watching?" I answered.

The bird watching had been great. My brother Murray, a professor in California, had been visiting Wisconsin and he had looked up Joe because I had

SPECIAL THANKS TO HELEN CRUICKSHANK

Young barred owls and Allan Cruickshank

> *". . . Cruickshank's imitative ability brought us the first bird of the day."*

spoken about him often. Together they had made a trip in which they had seen just about every species of owl ever recorded in that area and they wanted to tell me about it.

How could I forget Joe Hickey?

When I met him 50 years ago Joe was still an amateur ornithologist, but even then he seemed to know just about everything about birds. But that wouldn't have done me and my friends of the Sialis Bird Club much good, if he hadn't taken us under his wing. He not only pointed out new birds, but gave us a free course in what he later took up as his profession—conservation and wildlife management.

The introduction by John Bull to a recent edition of Hickey's classic book, *A Guide to Bird Watching,* says in part:

"His guidance inspired amateurs, particularly the younger observers, to engage in many worthwhile ornithological projects."

My projects have included Christmas and spring bird counts in New York and, for the past 25 years, in Southern Illinois, and the occasional columns I have written on bird watching. But those columns, to judge from the mail and phone calls I have received over the years, have brought hundreds (thousands?) of bird watchers out of the closet.

It all started when a high school biology teacher took a group of students, myself included, for a nature walk in Bronx Park. We wound up at the old stone bridge across the Bronx River that was the field headquarters for the bird watchers of the area. That's where I met Joe Hickey, and through him Peterson, Cruickshank, Irv Kassoy, Dick Herbert and other Bronx County boys.

And though I knew them only through bird walks, Christmas counts and meetings of the Linnaean Society, they turned a city kid who knew about only sparrows and pigeons into someone aware of the marvels of his natural surroundings, and of the importance of preserving the environment and conserving wildlife.

Especially the birds.

THE AUTHOR

Ben Gelman writes a biweekly column for *The Southern Illinoisan,* a newspaper based in Carbondale, Illinois.

Treasure in Argentina

Olin Sewall Pettingill, Jr.

OLIN SEWALL PETTINGILL, JR.

Argentina hosts many daytime raptors, including the yellow-headed caracara, above, and the crested caracara, right.

IN 1969, MY WIFE AND I had a month to spend searching for birds in Argentina. It was January, early summer in that country, and we were advised that the area for the best ornithological rewards was the lowland along the Rio Paraná, northeast of Buenos Aires. We knew next to nothing about such a place, precisely where to go and, least of all, travel conditions.

Luck was on our side when a friend of ours put us in touch with Maurice Rumboll, a young Argentine-born Scotsman who was a talented naturalist. He would be delighted to guide us.

But Maurice warned us in advance. Northeastern Argentina is strictly agricultural, far off the tourist track; hotels, motels, and camping grounds are practically nonexistent. We would need sleeping tents (be sure they are insect-proof) as well as the essential utilities for preparing meals. Although Maurice knew the owners of several huge estancias where we would be guests from time to time, mostly we would be on our own.

Fully equipped, we met Maurice in Buenos Aires as scheduled and at once hired a sturdy station wagon, acquired food supplies and accouterments that would be unavailable in the *campo*, and we were off, Maurice driving.

Maurice's warning about the country and the problems to come proved understated. Within a day we were in level, low-lying country, on roads, rarely paved, that threw up choking dust and proceeded over high grades bordered by water-filled ditches, occasionally canals, and beyond by wire fences enclosing croplands, pastures, and sometimes small woodlots. Pull-offs that offered enough space for camping, let alone shade, quiet, and privacy, were so few and far between that in desperation, after a torrid day, we were glad to step under the approach to a bridge, into some abandoned dooryard—anywhere as long as it was off the road.

No sooner had we removed our camping gear and shaken off the dust when we were targets for mosquitoes, clouds of them. Frantically we put up our tents, then prepared our supper and retreated to the stifling interior of the tents to consume our food and pass the night.

As for our other problems—and there were many—I shall say no more because they were incidental to our daily ornithological sights. Never before had I traveled in country richer in birdlife. There were so many species that drew our attention and tempted photography.

This was true from the time we left the outskirts of Buenos Aires. In ditches along the highway, rain recently had softened the clayey soil. From this mud, rufous ovenbirds were molding their huge domed nests on bordering fenceposts and utility poles. When dry, the structures would have the solidity of cement and an endurance that would last well beyond the one-time use of the builders. House sparrows and gray-breasted martins probably would occupy them in subsequent seasons. So impervious are the ovens to weather and predation that their exposure is never a factor in the sites selected as long as the surface for them is firm and flat. We saw one next to the top of a frame of a swinging gate, another on the vane support of a windmill.

Ovenbirds were everywhere, as prominent as their nests, flashing their reddish-brown tails and rumps in flight and, while perched, singing energetically, their loud descending notes ac-

OM MCHUGH (PHOTO RESEARCHERS, INC.)

companied by wing vibrations. Cocky birds, they searched for food on lawns of the estancias as if they were the owners, striding assuredly with broad steps, their chests puffed out, and seldom failing to chase any other bird that crossed their path. For vitality and boldness, as well as for their engineering feats of nest construction, little wonder that Argentines claim *el hornero* their national bird.

Here and there straddling the cross bars of utility poles or occasionally secure in the superstructure of windmills were shapeless bundles of sticks, nests of the firewood-gatherers which are close relatives of ovenbirds.

For bulk and conspicuousness, no nests rivaled those of the monk parakeets. Colonial breeders—exceptional among members of the parrot family—they massed sticks in trees, dead or alive, to form enormous dormitories in which each pair had its own quarters. Any grove with several trees supporting these colonies was absolute bedlam: screeches, shrieks, chattering, squabbles, and constant comings and goings. At one estancia where we were guests, we were aroused at dawn by a small colony just outside. Right then I shuddered at the thought of monk parakeets, already established in the New York and Florida areas, becoming widespread in the United States.

To be sure, a monk parakeet is a charming little creature by itself, pleasingly colored with shades of green and gray. Unfortunately, being so gregarious, it is never happy without others of its kind. Granted that we could endure the racket of monk parakeets as we have become accustomed to put up with the sounds from flocks of European starlings, however, we could not tolerate their feeding habits. In northeastern Argentina, flocks of several hundred individuals descend on fruits and grain crops of all sorts. So severe a pest are the parakeets that all landowners, we were told, are required to burn their nests every season or be subjected to a heavy fine. From our observations, few landowners seemed to have heeded any such regulations.

As we traveled daily, certain birds became familiar sights. Scores of eared and picui ground-doves flew up from the roadsides just ahead. Like mourning doves, they waited until the last moment, then rose as if flustered by something never seen before.

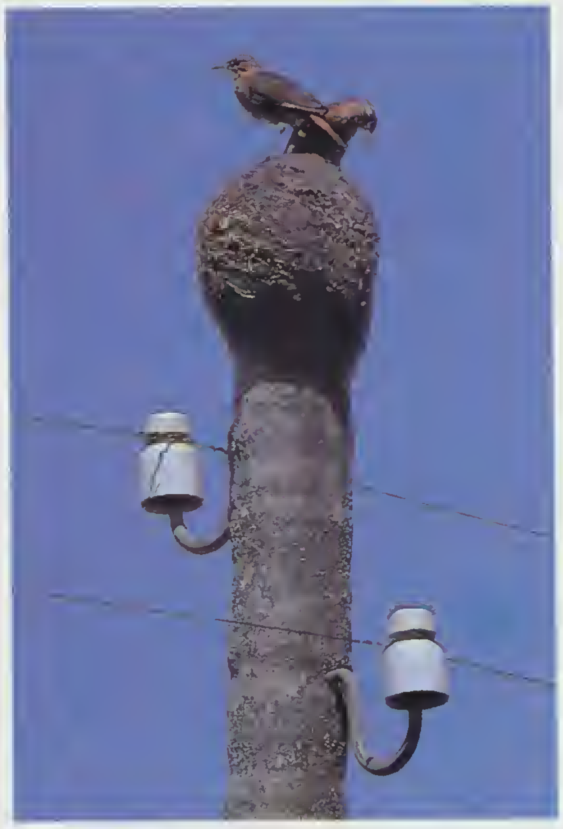
JEN & DES BARTLETT (BRUCE COLEMAN INC.)

Always eye-catching were guira cuckoos, distinctively marked. Small groups flying across the road encouraged us to slow down. Sometimes they chose to alight on a fence or post. When they did they fell forward, seemingly out of control, with their long tails flipping over their heads. On recovering their balance, the clownish birds raised and lowered their head plumes while letting their tails hang limp. Any wind ruffled their straggly feathers and waggled their tails.

Touring as we did in low country with so much wetland, I had not expected to see tinamous, primitive terrestrial birds which, in Argentina, ordinarily inhabit grassy uplands and scrub. But we often saw spotted tinamous, a species the size of a small grouse, scampering across the road. When we stopped at a site where one had disappeared, there was no sign of it. Of course the bird was there, somewhere, crouched and obscured by its spots and bars that so well matched the grasses and the shadows they cast. Not until we nearly stepped on it would it burst into the air with a startling roar of wings and be off out of sight.

Because of the type of country, I also had not expected to see rheas. Yet we noted a few now and then in pastures remote from the main highways where they sometimes grazed with cattle. They were greater rheas, a species standing over four feet tall. When there were no cattle in view for comparative height, they seemed as large as their African relatives, the ostriches. Generally wary, at the slightest glimpse of us they turned and strode away. "Going awaysters," I dubbed them, for we rarely watched them when they were not moving away from us.

Seldom, if ever, did we explore a field, pasture—any open stretch of land not under cultivation—without meeting southern lapwings. Strikingly handsome big plovers they were and especially so in flight when they displayed their boldly marked wings. Our initial charm with them, however, was soon replaced by downright annoyance owing to their habit of yammering when we neared their breeding territories and, worse still, alerting every other living thing to our presence. There was no escaping their clamor for as soon as we had passed through one territory—and endured the ear-splitting noise of its occupants—the lapwings owning the next territory took up where the others had left off. The local name for the lapwing is *tero-tero* from the sound of its calls. Before our trip was over we had our own names for the species, none complimentary.



OLIN SEWALL PETTINGILL, JR.

Rufous ovenbirds on their nest of mud. Left, southern lapwing, a noisy plover.

I was amazed at the prevalence of daytime raptors. Cinereous and long-winged harriers frequently sailed over ricefields and marshes; roadside, red-backed, and black-collared hawks perched unconcernedly in full view on fenceposts and tree stubs; crane hawks patrolled the forested edges of ponds and rivers; and black-chested buzzard-eagles soared over most any sort of country. There were three species of caracaras, all common, scouting farmlands for dead animals, animal wastes, insects, or whatever. The large crested caracara I had seen before in such widely separated points as south Florida and Falkland Islands in the South Atlantic, though never more than a few pairs. The chimango and yellow-headed caracaras, astonishingly tame, foraged around cattle or sometimes, as in the case of the yellow-headed, on the cattle where they relieved the animals of their ticks and other parasites.

And finally there were snail kites by the hundreds, on utility wires, fences, trees, anything for perches, as long as they were convenient to water-filled ditches and channels that produced their specialized diet, restricted to freshwater snails of the genus *Pomacea*. At

JAMES HANCOCK (PHOTO RESEARCHERS, INC.)

Young whistling herons on nest, above. The southern screamer, right, is a "conglomerate of several kinds of birds."

the bases of fenceposts we noted heaps—bushels—of shells, dropped by the birds from the post tops where they had extracted the contents.

My amazement at the prevalence of raptors, after being conditioned to their scarcity in the United States, prompted me to ask Maurice, "Why so many?" His answer: "Most people, excepting the wealthier landowners, can't afford ammunition, even if they had guns, to shoot birds for sport or any other reason." James Cook, our host at his estancia, had another answer: "We don't shower our country with pesticides to the extent that you do!"

Our month's attention to Argentine birds impressed upon us the rich diversity of species. Not that we were really surprised since over a third of the world's 9,000 species breed in South America—the "Bird Continent"—and over 900 in Argentina alone. The woodpeckers, for instance. In Argentina there are 33 species (compared to 21 in the United States), 13 of which reside in northeastern Argentina. Without trying we readily saw seven, including the ever-common field flickers and golden-breasted woodpeckers, and occasionally white woodpeckers. One evening near our campsite we counted seven white woodpeckers entering one cavity in a utility pole.

Without question, the birds greatest in number of species and diversity in form, color, and ecological adaptations were the tyrant flycatchers. Whereas the United States has 35 flycatchers—kingbirds, phoebes, pewees, and so on—Argentina has 113. We saw only a sampling. Examples: along the highways, the graceful fork-tailed flycatchers hawking insects from trees and wires; in marshes, both the white-headed marsh-tyrant and pied water-tyrant, as well as the spectacled tyrant, totally black save for its conspicuous yellow wattles around the eyes and white on the wings that showed up in flight. In pastures, the cattle tyrants rode on the backs of horses as well as cattle when not looking for insects stirred up by the animals' feet. In brushy lands, we saw a surprising bird for a passerine, the white monjita, all white except for black on the wings and tip of the bill. The most prominent of all the flycatchers, if not the commonest, was the noisy great kiskadee. Though I had become familiar with the species in Mexico, as I observed it here, frequently around water, it seemed much less a flycatcher than a frogcatcher and fisherman.

Several times on the marshy edges of open water we watched whistling herons. Yes, herons that really whistle. That this species should have any such capability, when the usual heron repertoire consists of croaks, quawks, and similarly guttural utterances, seemed impossible. But true it is. High up in a bottle tree in the yard of James Cook's estancia was a whistling heron's nest with two large nestlings. During a severe storm, while the nest was lashed by a gale and drenched with rain, a parent bird sometimes whistled as it strove to hang on to the nest and cover its brood. The sound was plaintive and clear—loud enough for us to hear above the wind.

Among all the birds observed, the most bizarre was the southern screamer. The more I watched the bird the more I thought of it as a conglomerate of several kinds of birds. It has the size, shape, and bill of a turkey. After a running start it could take off and soar high on the thermals with the ease of a vulture. When sunning itself it spreads its wings, cormorant fashion. Probably more a waterfowl than anything else, it could swim, though poorly, since its legs were the length of a wading bird's and its feet barely webbed. When disturbed, its loud trumpeting calls suggested those of a swan or a goose. We saw many screamers in pairs or flocks, sometimes near water but more often in pastures where they grazed along with cattle. Spotting one bird in a flock that for some reason was unable to fly, Maurice captured it so that we could examine its formidable defense weapons—two pairs of sharp spurs near the bend of the wings.

Adding to the great variety of Argentine birds that we encountered were species from North America, here for the austral summer. Enormous flocks of bobolinks circled the ricefields, descending to feed on the rice that had reached the delectable milk stage. Pests they were to the farmers who called them *charlatans.* And there were North American shorebirds. Once we counted as many as seven upland sandpipers, each standing alone on as many fenceposts in a row. At another time we came upon a small flock of buff-breasted sandpipers in a grassy field.

Excited as my wife and I were upon seeing hosts of birds new to us, we never failed also to be excited upon seeing familiar ones in a foreign setting—not breeding, just passing their winter. In North America we have no comparable situation, of South American birds migrating north to escape their winter in our summer. For variety and abundance of birds, Argentina hardly needs species from North America too.

Author's Note

I have no evidence that Argentina's political and economic problems since 1969 have affected wild birds and their habitats in the northeastern part of the country. However, most of the major roads are now paved and the provincial tourist boards have created campsites along the roads for the hordes of camping tourists.

FURTHER READING

Dunning, John S. *South American Land Birds: A Photographic Aid to Identification.* Harrowood Books, Newtown Square, Pennsylvania. 1982.

Meyer de Schauensee, Rodolphe. *A Guide to the Birds of South America.* The Academy of Natural Sciences of Philadelphia. 1970.

THE AUTHOR

Olin Sewall Pettingill, Jr. is a former director of the Laboratory of Ornithology, author of numerous books and articles on birds, and 1974 winner of the Arthur A. Allen Award.

LAWRENCE E. NAYLOR (PHOTO RESEARCHERS, INC.)

NEWS & NOTES

The Laboratory's Library of Natural Sounds (LNS), with its extensive collection of African bird recordings, is providing information for the new *Handbook of African Birds.* Volume 2 of this major work is now in production. Recently LNS furnished sound recordings and audiospectrographs to C. Hilary Fry of Aberdeen University for his studies of African kingfishers in the genus *Halcyon.* These species are of special interest because their sounds are excellent examples of adaptation to different habitats: the deep forest species have simple whistled notes, while those species living in open areas have harsh rattle-like calls. The recordings were collected by Laboratory field collaborators Myles North, Peter Kaestner, and Stuart Keith. As work proceeds on the new books, LNS will continue to provide materials to the editors and authors.

S. Dillon Ripley, biologist, ecologist, authority on the birds of the Far East, educator and museum administrator, will receive the 16th Arthur A. Allen Award at a dinner to be held in his honor in Ithaca, New York on October 13, 1984.

Dr. Ripley has served as secretary of the Smithsonian Institution for the past 20 years. Under his leadership, the Smithsonian has become world-renowned for its exploration of scientific frontiers and its contributions to the arts and humanities.

Some of the major events to occur since Dr. Ripley became secretary in 1964 are: National Museum of History and Technology opened, Chesapeake Bay Center for Environmental Studies was established, Woodrow Wilson International Center for Scholars was begun, *Smithsonian* magazine was launched, pandas came to the National Zoo and a 10-year renovation of the Zoo was started, *The Wilson Quarterly* was first published, the National Air and Space Museum opened to the public and "Smithsonian World" premiered on public television.

In addition to heading the Smithsonian, Dr. Ripley is president emeritus of the International Council for Bird Preservation, and is a member of the board of directors of the World Wildlife Fund—U.S. He has also authored numerous books, including *Trail of the Money Bird* (1942), *A Handbook of Birds of India and Pakistan,* 10 volumes (1968–74), *A Pictorial Guide to Birds of the Indian Subcontinent* (1983), and "A Portfolio Edition of Rails of the World" (1984).

The Arthur A. Allen Award was established by the Cornell Laboratory of Ornithology in 1966 in memory of Arthur A. Allen. The award is given in recognition of outstanding contributions to ornithology.

Ruby-throated hummingbirds are dying because of red electric fence insulators. The birds, which often feed on red flowers, apparently attempt to feed on the insulators; when the birds probe the insulators with their bills, they are electrocuted. The problem is most severe during migration, and occurs throughout the species' range, which is all of the United States east of the Great Plains. Electric fence insulators are available in white and black, and landowners are advised to use these instead of red ones.

Charles R. Smith, director of public education at the Laboratory of Ornithology, has been elected president of the Federation of New York State Bird Clubs. This position is an important part of the Laboratory's goal of maintaining working relationships with other ornithological organizations. The Laboratory is involved in a large-scale Federation project, the New York State Breeding Bird Atlas, which is determining the breeding ranges of all New York birds. Charles Smith also represents the Laboratory as a delegate to the International Council for Bird Preservation—U.S. Section, and is a member of the New York State Audubon Wildlife Advisory Committee.

You are invited to sponsor a color photograph in *The Living Bird Quarterly.* Gifts of $200 will pay for a cover; $150 supports a full-page photo. Smaller donations will sponsor smaller photos. Gifts will be acknowledged alongside the photo. Send your donations to: Editor, *The Living Bird Quarterly,* Sapsucker Woods, Ithaca, New York 14850.

The Living Bird Quarterly will hold its first photo contest in early 1985. The contest will be open only to amateur photographers, and will be judged by Les Line, editor of *Audubon,* and W. Allan Royce of *National Geographic.* Winning photos will

James Gulledge and Greg Budney collect bird sounds for the Library of Natural Sounds.

DAVID BLANTON

appear in the *Quarterly,* so start taking your prize-winning photos now.

Also, the *Quarterly* has received an exceptional achievement award from the Council for the Advancement and Support of Education (CASE), Washington, D.C.

The Laboratory of Ornithology is pleased to announce the receipt of a three-year grant of $150,000 from the Exxon Corporation. The money will be used to stimulate growth and development of the Laboratory and its programs.

A new annual journal, *Bird Conservation,* is being published by the U.S. Section of the International Council for Bird Preservation. The semi-technical publication is designed to disseminate information on bird conservation activities. Each issue will include reports on specific conservation programs written by biologists working on the projects. Edited by Stanley A. Temple, Beers-Bascom Professor of Conservation at the University of Wisconsin-Madison, the first issue contains articles on the peregrine falcon, bald eagle, and California condor. It is available for $12.95 plus $1.00 shipping from the University of Wisconsin Press, 114 North Murray Street, Madison, Wisconsin 53715 (Wisconsin residents add $.65 sales tax), or from the Crow's Nest Bookshop ($12.95 plus $2.00 shipping; 10 percent discount for Laboratory members; New York residents add $.91 sales tax).

The Santa Barbara song sparrow has been removed from the U.S. List of Endangered and Threatened Wildlife and Plants because it is presumed extinct. This subspecies was found only on Santa Barbara Island, part of the Channel Islands National Monument off the Southern California coast. The birds were common prior to 1959, when a fire devastated much of the island. Since that year, no one has seen a Santa Barbara song sparrow despite many attempts to find them by ornithologists, including National Park Service naturalists living on the island.

A new publication concerning the serious problem of lead poisoning in waterfowl is available from the National Wildlife Federation. *Steel Shot and Lead Poisoning in Waterfowl* by J. Scott Feierabend is an annotated bibliography of research published from 1976 to 1983. Copies are available for $4.95 plus $1.55 shipping from the National Wildlife Federation, 1412 16th Street, N.W., Washington, D.C. 20036.

The Laboratory's Cooperative Research Program (CRP) reports that data from its files are being used to monitor potentially imperiled birds and to assess the impact of industrial development on certain bird species. Wisconsin Department of Natural Resources recently requested all nesting records for endangered and threatened Wisconsin birds such as the red-necked grebe and the loggerhead shrike. The Adirondack Conservancy, part of the Nature Conservancy, has asked for breeding records for use in its rare animal project. Patuxent Wildlife Research Center of the U.S. Fish and Wildlife Service requested records to help assess the impact of coal development on inland nesting least terns, white-faced ibises, and double-crested cormorants, and several consulting firms have applied for data to use in environmental impact studies.

CRP data are contributed by dedicated amateur birders as well as professional field ornithologists. After observing nests or breeding colonies, contributors submit information on special forms. These records are available for a small fee to any amateur or professional researcher who submits an outline explaining how the data will be used.

Gregory S. Butcher recently joined the staff of the Cooperative Research Program to investigate ways of using Audubon Christmas Bird Count data to study the movements and distributions of wintering birds. The Christmas Bird Count is the oldest and most popular volunteer census effort, yet much of the data contained in the counts have not been analyzed. The Cooperative Research Program hopes to obtain the financing to computerize the data so they can be used in long-term population studies of many North American bird species.

The Living Bird, the Laboratory's annual journal for 19 years, has become a collector's item. A leading publication in ornithological research, it combines technical articles and exquisite colorplates. The Laboratory is now offering a limited number of complete sets (some imperfect) of *The Living Bird* to our members. Cost: $1,000. Mail your request and check or money order to Library, Laboratory of Ornithology, Sapsucker Woods, Ithaca, New York 14850.

Macaw tail feathers from captive birds are needed to prevent the slaughter of wild macaws in Panama. Certain Panamanian Indian tribes wear these feathers in ceremonial dances and are endangering several species of macaws to obtain them. The Panamanian National Section of the International Council for Bird Preservation is attempting to obtain enough feathers from captive birds to meet the demand. Anyone having access to captive macaws is urged to donate molted tail feathers, which can be sent to Eugene Morton, Secretary, Pan America Section-ICBP, National Zoological Park, Washington, D.C. 20009.

Dear Member:

The continued growth of the human population poses threats, both obvious and subtle, to many species of plants and animals. Obvious changes in the natural landscape, such as housing developments and shopping centers, force wildlife to move away—if it can. Covering wetlands with parking lots or draining them for agriculture plays havoc with plants and animals that depend upon wetlands for survival.

Subtle alterations we make in the environment are not seen immediately, but are just as serious. Chemicals used in agriculture and industry can bring disaster: none of us needs to be reminded of the effects of DDT on bird populations. And now acid rain caused by various types of emissions seems to be taking its toll on a worldwide scale.

Another insidious disrupter is known as habitat fragmentation; as natural areas are divided by roads and buildings, individual blocks of forest or field become smaller and the distances among them become greater. As the amount of habitat diminishes, the number of birds that require large areas of unbroken habitat also decreases. Fragmentation also results in more "edge"—the border between two habitats, such as woods and fields. Result: edge dwellers become more numerous while birds once hidden in the forest are brought closer to the open. Increased edge may explain the growing number of cowbirds throughout much of North America. Female cowbirds perch in trees along the woodland edge where they watch small songbirds whose nests they may later parasitize.

At the Laboratory we are studying the effects of human activity on bird numbers. Our Cooperative Research Program monitors changes in bird populations by collecting and examining breeding data. At our research program at the Seatuck National Wildlife Refuge on Long Island, we are learning how to manage songbird habitats in a suburban environment. And many articles in the Quarterly *discuss these concerns, for example, last autumn's "Birds in a Patchwork Landscape" and this issue's "Wetland Sentinels."*

Birds are the focus of our efforts to understand how human activities affect plants and animals. Such an understanding will help us preserve the richness of species for future generations.

CHARLES WALCOTT, *Executive Director*

RESEARCH & REVIEW

Richard E. Bonney, Jr.

New Field Guides

North American birders have come a long way in the 50 years since Roger Tory Peterson wrote his classic *A Field Guide to the Birds*. The degree of birding sophistication now attained is reflected in two excellent new field guides: *The Audubon Society Master Guide to Birding*, edited by John Farrand, Jr. (Alfred A. Knopf, 1983, 3 volumes, soft cover, 1,244 pages total, $13.95/volume), and National Geographic's *Field Guide to the Birds of North America* (1983, 464 pages, soft cover, $15.95).

The *Master Guide* is very thorough. It includes 835 species—all those known to breed in North America plus all 116 species that have visited the continent—with accounts written by 61 ornithological experts. The guide contains a wealth of detailed text for each species, including general information, a description of the bird's physical and vocal characteristics, and a discussion of similar species. There is also an explanation of each species' range along with a small map.

The book, however, is really a reference rather than a field guide, for three reasons. First, the bulk of the three volumes makes them awkward to carry. Second, the guide uses photographs rather than illustrations to depict many species. While most of the photos are excellent, they do not portray field marks the way a good illustration does. In the photo of the hermit thrush, the diagnostic red tail is barely noticeable; other field guides with illustrations, such as Peterson's, show the tail clearly. Third, the guide has no comparative illustrations showing similar-looking species.

The Geographic guide is more useful in the field, although it too is heavy and bulky. While not as comprehensive as the *Master Guide*, it does include all the species known to breed in North America, plus a few visitors. The 220 colorplates are generally of high quality. They were prepared by 13 artists, and include many illustrations of birds in subadult and seasonal plumages, a tremendous help in identifying species with highly variable plumages. Several plates show birds in flight. For each species, written descriptions discuss physical characteristics, habitat, and voice. Range information is presented on tiny range maps which, for some species, are difficult to interpret.

Beginners will find both of these guides somewhat overwhelming and may be better off learning from the less complex guides by Roger Tory Peterson, either the revised *A Field Guide to the Birds East of the Rockies* (Houghton Mifflin, 1980, $9.95) or *A Field Guide to Western Birds* (Houghton Mifflin, 1961, $11.95). Or, for those birders who don't mind a guide that contains birds not found in their part of the country, there is Robbins, Bruun and Zim's recently revised *Birds of North America* (Golden Press, 1983, $7.95). Both the Peterson and Robbins guides can be carried in a large pocket. Even advanced birders probably will continue to rely on these favorites while in the field, leaving the Geographic and Audubon Society guides in the car or at home for use in confirming confusing sightings.

Tyrant Bird

The eastern kingbird has been described as defiant, fierce, and belligerent. During breeding season this member of the flycatcher family often harasses other birds, including much larger crows and hawks. There is one report of an eastern kingbird attacking a low-flying airplane. Why is this bird so aggressive? Peter Blancher and Raleigh Robertson of Queen's University, Ontario, have discovered a probable answer ("Kingbird aggression: does it deter predation?" *Animal Behaviour*, vol. 30, pp. 929–930).

Blancher and Robertson studied 32 pairs of kingbirds nesting along Lake Opinicon, Ontario. During nest checks from a boat, the researchers measured the kingbirds' reactions to their presence. Reactions ranged from silently observing the two men to striking them with their bills. After several checks, the researchers calculated an aggression score for each pair.

By the end of the study, 14 of the 32 nests had lost eggs or young to predators. These nests belonged to birds with the lowest aggression scores, leading Blancher and Robertson to conclude that a high level of aggression by kingbirds is an effective defense against predation. This idea is supported by the fact that aggressiveness of all pairs increased as the breeding season progressed; biologists believe that the more time and energy parents have invested in their young, the more likely they will be to risk their lives defending the young.

Unfortunately, the study cannot answer an intriguing question: why should eastern kingbirds be more aggressive than other songbirds? Perhaps the answer lies in the kingbird's aerial agility; the superb maneuverability that enables the bird to capture its insect prey in midair also may reduce its chances of being captured while harassing predators, so it can afford to be daring. Robert Ricklefs of the University of Pennsylvania has shown that several other aerial insectivores also are aggressive.

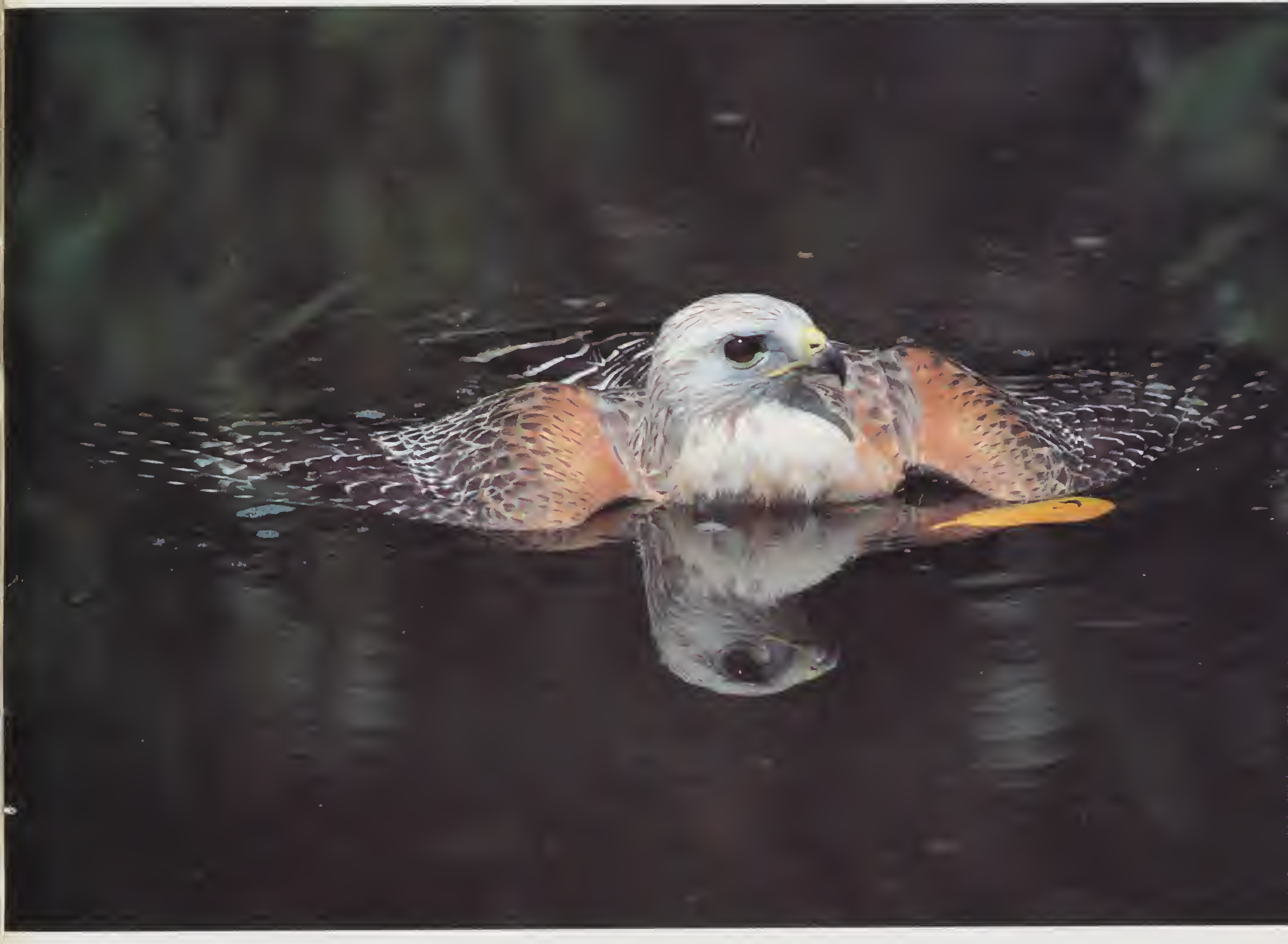
Habitat Separation

Many bird species are restricted to one type of habitat. Three-toed woodpeckers reside in coniferous forests, while meadowlarks inhabit fields. Other species, however, live in a variety of habitats; for example, the European sparrowhawk is found in both forests and fields. M. Marquiss and I. Newton of the Institute of Terrestrial Ecology, United Kingdom, have discovered that preference for one type of habitat over another may be determined by the sex of the sparrowhawk ("Habitat preference in male and female sparrowhawks *Accipiter nisus*," *Ibis*, vol. 124, pp. 324–328).

Marquiss and Newton noted the sexes of 450 sparrowhawks in three different habitats in south Scotland: coniferous forest, farmland with small woods, and open farmland with no woods. The researchers discovered that the ratio of males to females differed depending on habitat. In the forest, males outnumbered females nearly three to one; in the farmland with woods the numbers were about equal; and in the open farmland, females outnumbered males more than two to one.

In this species, as in most birds of prey, females are much larger than males. Marquiss and Newton believe size difference may explain why males prefer woodlands while females favor open country. First, because they are smaller, the males are probably more maneuverable than females in the forest's thick cover. Second, by keeping under cover, males may reduce their chances of being preyed upon by the females. Third, females may find their preferred prey—larger birds, such as thrushes and starlings—more available in open farmland than in extensive woods.

There may be other reasons for the habitat preferences discovered by Marquiss and Newton. But whatever the reasons, separation by sex has an important ecological benefit to the species. It reduces competition for food, making it easier for males and females to coexist in the same area. For species where the two sexes use the same habitat, competition may be avoided by other means. For example, the sexes may feed in different parts of trees or may feed on different types of prey.



Bon Appetit!

WHILE DRIVING through the Ding Darling National Wildlife Refuge on Sanibel Island, Florida in March of 1983, my wife and I saw a red-shouldered hawk perched near the road. A channel about 15 feet wide separates the roadside from a mangrove forest. We stopped, set our camera on a tripod, and waited for something to happen. After a few minutes, the hawk dropped into the channel where he remained still, floating with his wings spread, glancing about. A minute later he drifted about three feet from shore and began rowing violently toward it. Coming out of the water, he shook himself and then hopped up the bank. At this point we saw that he had a large rat in his talons. After mantling over the rat for a minute, he flew across the channel, landed on a tree limb, and ate his catch. *—J. Kent Minichiello*

Wetland Sentinels

Donald A. McCrimmon, Jr.

UNTIL A FEW DECADES ago, wetlands were regarded as waste areas to be drained and filled for agricultural or industrial development, housing projects, or railroad rights of way. Earlier, a few naturalists had championed the biological, economic and aesthetic importance of wetlands, but only recently have large numbers of people come to appreciate the important role wetlands play in the natural world.

Wetlands are places where the soil is saturated with water. They include bogs, where the water is below the land's surface; swamps, which are flooded woodlands, and marshes, which are flooded grasslands. The benefits of wetlands vary. Salt marshes are extremely productive, providing food and shelter for a variety of fish and wildlife, not just in the immediate area, but in surrounding coastal ecosystems. The dependence of commercial and sport fisheries on salt marshes as nurseries for fish, shrimp, and oysters is a significant economic justification for preserving these areas.

Freshwater wetlands not only feed and shelter invertebrates, fish, birds, and mammals, but also absorb large quantities of water, releasing it slowly. By filtering sediment and other pollutants, freshwater wetlands can maintain or improve downstream water quality. They also may replenish groundwater supplies.

Biologists have been trying to monitor the health of wetland ecosystems because of their value. One way we determine if a wetland is functioning properly is to watch for changes in the animals that live on it. Have feeding or reproductive patterns altered in a surprising or dramatic fashion? If so, we attempt to find out what the changes mean.

Certain animals are better than others in helping us gauge a wetland's health. These animals could be called environmental monitors and are suited to this role because of the positions they occupy in their ecosystems.

The primary producers in an ecosystem are green plants. They rely on photosynthesis, the use of energy from the sun to manufacture their own tissue from materials in water, soil, and air. Animals cannot use photosynthesis, but must obtain energy and nutrients by eating plants, other animals, or both. One way to think of the ecosystem's structure is as a series of feeding levels, starting with plants and moving up to

The great blue heron has been used as a wetland monitor. The bird's position at the top of food webs makes it susceptible to environmental change. At left, great blue fishing from kelp bed. Below, herons at dawn at Concord, Massachusetts.

MARK WILSON

plant-eating animals (herbivores), and then animal-eating animals (carnivores). Since most animals eat more than one kind of food (omnivores) and may switch feeding levels, the structure of an ecosystem is often called a food web.

Several important features of ecosystems result from these relationships. First, since all members of the system are interconnected, removing any part of the web influences the entire system. The degree of disruption varies, but generally those animals at the tops of food webs—known as top carnivores—are most sensitive to changes in other parts of the web, especially in food quality or availability.

Second, chemicals, both nutrient and pollutant that are present in an ecosystem, are taken up initially and concentrated by plants. Herbivores eating the plants concentrate these chemicals further. Carnivores, feeding on herbivores, omnivores, or on each other, ingest the greatest concentration of all—equivalent to many plants'-worth of pollutants.

Because of their top position in the food web, wading birds—herons and egrets—are among the best environmental monitors, and of the wading birds, great blue herons have been of particular interest. The species is conspicuous and easily recognized, and trends in the status of its breeding population have been the subject of intense speculation and investigation.

Although solitary much of the year, great blue herons nest in the tops of trees in colonies near rivers, lakes, swamps, or marshes. Colony size ranges from two to hundreds of pairs, and colony sites may be reused for many years. During the nesting season, the birds feed near the colonies on fish, amphibians, crustaceans, birds, mammals, and insects. The combination of carnivory, conspicuousness, and large numbers in small areas, have contributed to the great blue heron's attractiveness as a monitor species.

Recently, I became interested in great blue herons both as a species and an ecological monitor because, in the last decade, some conservationists believed that the species had become reduced in numbers. Precise and complete counts of great blue populations spanning many years were almost nonexistent and evidence for population declines was anecdotal. Nonetheless, the persistence of such reports, particularly in central and midwestern states, led the National Audubon Society to "bluelist" the species for several years during the 1970s. Great blue herons thus were regarded with special concern, and amateur and professional ornithologists were asked to pay close attention to what was happening to birds that were breeding and feeding in their areas.

Volunteer ornithologists in New York State already had been following great blue heron population trends for quite some time. Pesticides such as DDT had led to serious reproductive failure from eggshell thinning in other monitor birds, such as bald eagles, and it was thought that wading birds also might be vulnerable to this threat. As a result, Walter Benning, a noted New York amateur ornithologist, and a group of volunteers from the Federation of New York State Bird Clubs censused great blue heron colonies from 1964 to 1968. These data provided a very useful background for the studies I began in 1979.

To gather more data quickly, I de-

TIM FITZHARRIS

cided to combine Benning's approach of using volunteers to help locate great blue heron colonies with aerial surveys. I also enlarged the network of volunteers by appealing for aid through the media. Hundreds of news releases asking for help in locating colonies were sent to newspapers and garden and bird clubs throughout the state. The news releases were written in an engaging style by Marnie Crowell whose book, *Great Blue,* at the same time was being published by Times Books. Hundreds of people from all walks of life responded to our request for information.

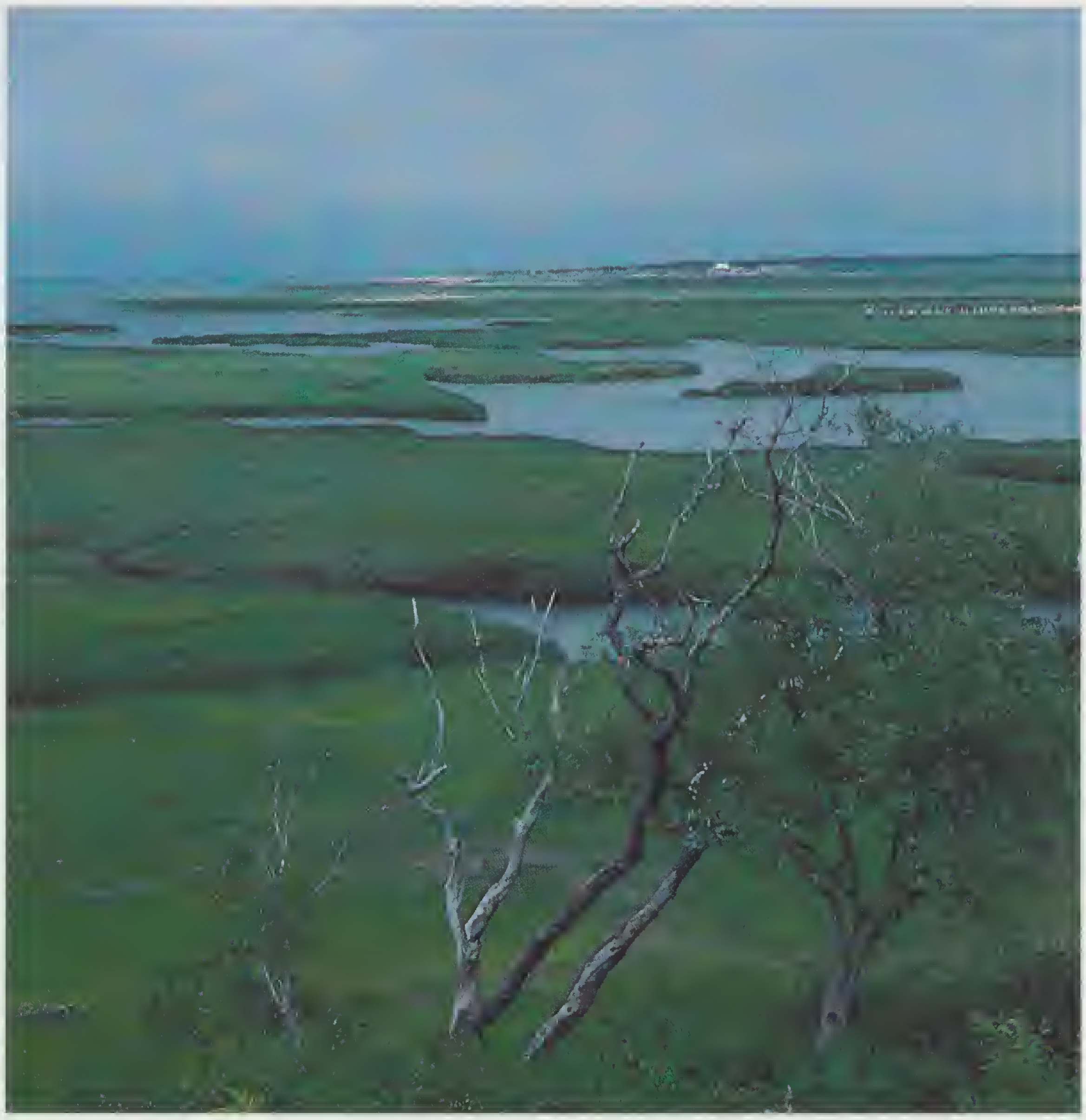
Once colonies were located, I, two assistants, and a highly experienced pilot took a small airplane over the colonies at low altitude and counted the number of active nests. We surveyed from 1979 through 1981, working in late April and early May. In no instance did our searches disturb the nesting birds.

Combining the results of our surveys with data from the Laboratory of Ornithology's Colonial Bird Register, we identified 110 colonies in upstate New York. In the 1960s there had been only 41. (No active great blue colonies have been reported on Long Island for many decades.) Further, the average colony size of 50 nests had more than doubled compared to data from the '60s. Thus I concluded that the population of great blue herons in upstate New York is robust.

How would I account for this? My study showed that the habitats where New York heronries are found have not changed noticeably over the past two decades, despite the fact that some areas of New York are losing wetlands. Furthermore, the total amount of habitat suitable for nesting great blues probably has increased. In New York, many wetlands that once were drained and modified for farming have been abandoned, allowing them to revert to their natural condition. In addition, beavers, notorious wetland creators, have experienced a resurgence in the state. Beaver ponds can serve as good nesting and foraging sites for great blues and their mutual relationship is a subject deserving further study.

For several years, the New York State Department of Environmental Conservation has been mapping and evaluating the state's wetlands. Approxi-

Far left: fish are the great blue heron's main prey. Below left: salt marshes provide food and shelter for fish and wildlife. This one is on Cape Cod. Right, above: Don McCrimmon surveyed heron colonies from a small airplane. Right, below: beavers are notorious wetland creators.



VIRGINIA P. WEINLAND (PHOTO RESEARCHERS, INC.)

DAVID BLANTON

DENNIS W. SCHMIDT (VALAN PHOTOS)

mately 3 percent, or one million acres, of New York's land area is wetland habitat. Since 1968 some wetland areas, especially in urban settings, have declined. Great blue herons, however, rarely nest in these settings.

Other explanations for the robust status of New York's great blue heron population may be proposed, but none is as convincing as increased habitat availability. Reduction in pesticide residue in the environment is one alternative. Other species of fish-eating birds recently have rebounded dramatically following decreased exposure to pesticides. Ospreys and brown pelicans have shown striking improvement. Pesticides, however, have been linked to eggshell thinning and reproductive failure among only a few wading bird species. The great blue heron has not been shown to be affected.

Great blue heron populations in other parts of the United States have not fared as well. For many decades, urbanization, industrialization, waterway development and agriculture have caused much wetland habitat loss along the Mississippi River flood plain. Such loss is associated with reported declines in populations of great blue herons and great egrets in southern Iowa, Illinois and Missouri. Also over the past 25 years, declines in populations of wood storks, a wetland-dependent bird in southern Florida, parallel an estimated 35 percent reduction in wetlands important as feeding sites.

Habitat-sensitive wading birds such as great blue herons may face trying times in the years ahead. Human-induced changes in habitat will be the main reason. The mere presence of people near a colony can have a significant influence; most wading birds are intolerant of repeated human disturbance, particularly early in the nesting season. Adult birds can be frightened away and high nestling mortality can result. In the southeast United States, human population density is increasing so rapidly that more and more often wading birds must try to nest near intense human activity.

In the relatively healthy environment of upstate New York, great blue herons already may be facing some problems. In the Adirondack Mountains, surprisingly few great blue heronries are reported. Acid rain has severely reduced fish populations through death and reproductive failure in many of New York's mountain lakes and streams. Without fish to eat, great blue herons can hardly be expected to breed successfully. Also, throughout the state, the increase in woodcutting for use in wood-burning stoves has the potential to disrupt great blue heron colonies.

If present trends persist, chances are that future generations of great blues in the United States will inherit an increasingly manipulated landscape, with fewer wetlands wild enough for these wary birds. Our challenge as biologists and conservationists is to learn enough about the resource requirements of both birds and people to protect and preserve critical habitats. This is particularly true for the management of wetlands, upon whose integrity so much life depends.

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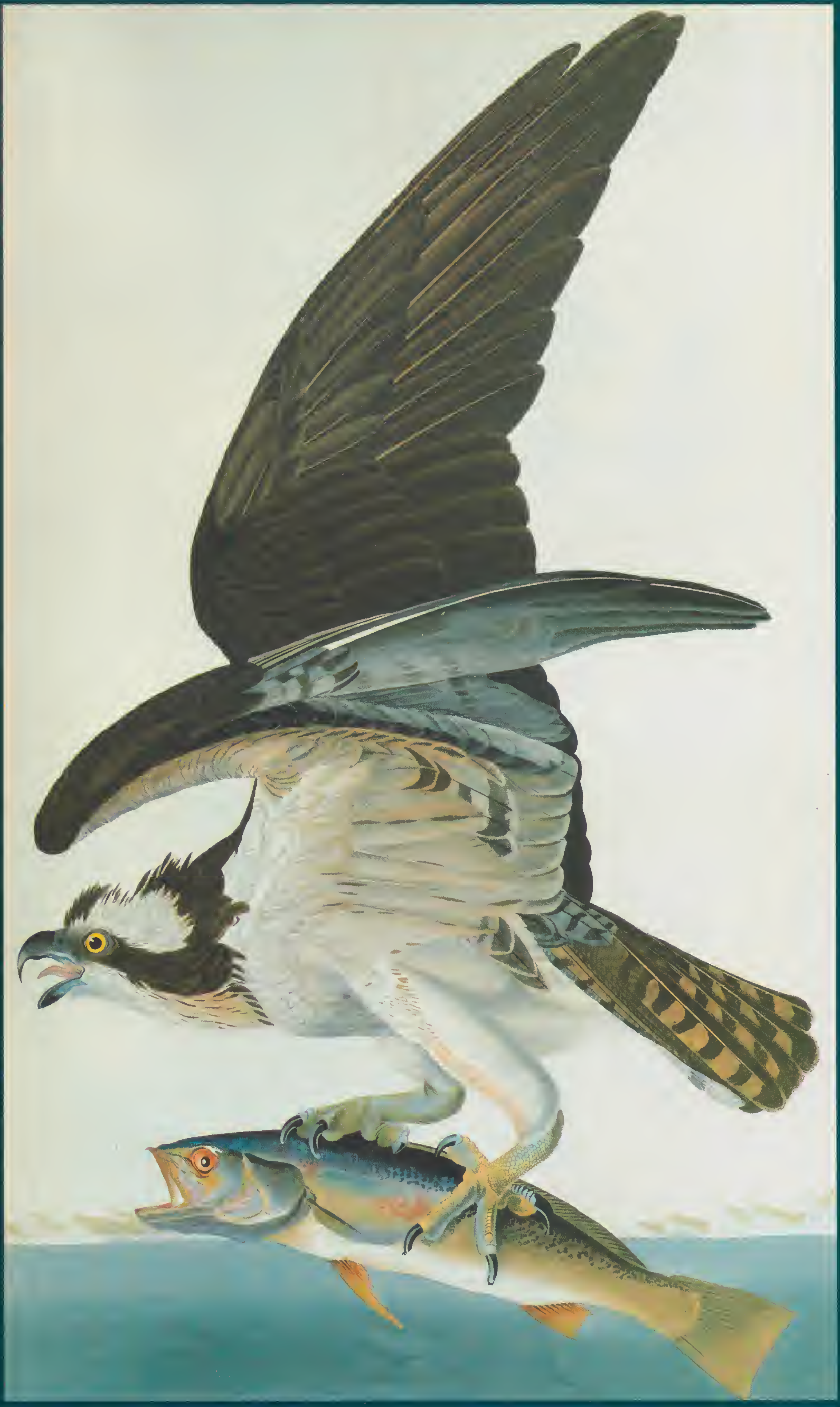
THE AUTHOR

Donald A. McCrimmon, Jr., is director of the Laboratory of Ornithology Cooperative Research Program.

STEVE MASLOWSKI

The osprey, another fish eater, declined in numbers because of pesticide contamination. Osprey populations are recovering in some areas. At right, painting of osprey by John James Audubon.



THE LIVING BIRD

Quarterly

Autumn 1984

Laboratory of Ornithology
159 Sapsucker Woods Road
Cornell University
Ithaca, New York 14850

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THE LIVING BIRD *Quarterly*

Autumn 1984
Volume 3 Number 4

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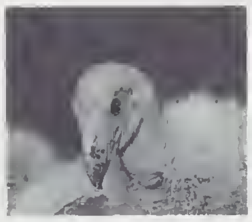
Front Cover. Outside—Belted kingfisher. Photograph by Tim Fitzharris. Thanks to the Laboratory's 1984 Field Ornithology class for its gift for printing our front cover. Inside—Northern waterthrush. Photograph by Barth Schorre (Bruce Coleman Inc.).
Back Cover. Outside—Bonaparte's gull preening. Photograph by Tim Fitzharris. Inside—Gray partridge by Aleta Karstad.



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Day of the Condor

Philip K. Ensley

A veterinarian from the San Diego Zoo describes a historic capture of a wild California condor

Topa Topa, 1970, in cave at Los Angeles Zoo.

BHL

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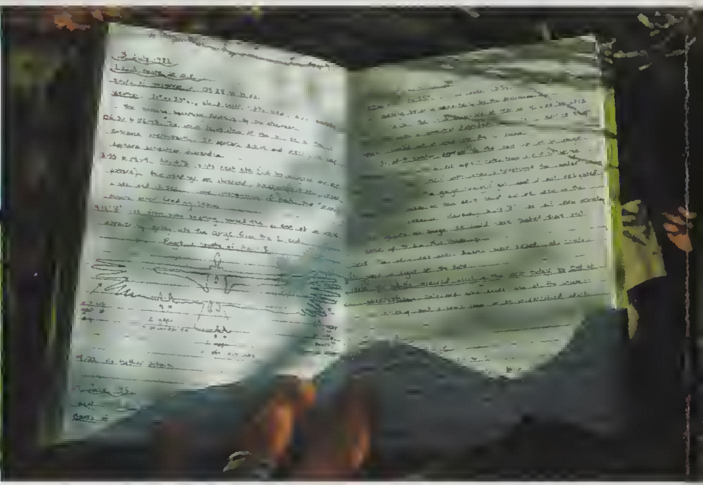
1) Chick is flown to San Diego Zoo. 2) Nests are constantly watched. 3) A record is kept of all activity at the nest.



I AM A VETERINARIAN from the San Diego Zoo and was part of a team of scientists from the National Audubon Society and the U.S. Fish and Wildlife Service who, in 1982, captured one of the few remaining free-flying California condors. In October of that year, operating under a permit from the federal government and the California Department of Fish and Game, we were ready to implement our plan.

The strategy for saving this majestic bird from extinction hinges on the success of two efforts. One—we must monitor the estimated 20 remaining birds in the wild, and two—we must increase the size of the wild population with offspring produced by captive birds in the Los Angeles and San Diego Zoos.

Condors occupy the rugged mountainous terrain surrounding the southern San Joaquin Valley north and west of Los Angeles. Field observation is nearly impossible, but with radio transmitters attached to the birds' wings we can follow the birds to their roosts at night, find out where they feed, on what and how often. By understanding their requirements, we will be able to release and integrate captive-reared birds into the wild population, thereby augmenting their chance for survival.

In the wild, adult California condors usually nest only once every other year. In captivity, however, we can induce the birds to breed every year by removing each egg as it is laid and incubating it artificially. The adults then will breed again and the female will lay a second egg. By using this method a captive pair of breeding adults can produce two or three chicks a year.

Critics say, "Why don't you leave the California condor alone? Invasive procedures may do more harm than good." After decades of watching the population decline, a more productive course has become necessary. Meanwhile the shooting, habitat alteration, thinning of the birds' eggshells as a result of pesticide contamination, and the condors' inability to cope with human disturbances, have contributed to the species' near demise. Knowledgeable investigators agree if the present situation is left as is, the wild population of California condors may be extinct in less than a decade.

Critics say "Why don't you leave the California condor alone?"

My job on the project was to provide medical support during the capture of the wild bird. Our permits required a veterinarian during capture, handling, physical examination, tagging, releasing, holding, and transporting of California condors.

Our success in capturing a wild condor demanded split-second timing and careful planning by a team of highly trained biologists. So, on the day of the capture we were at the baitsite practicing the procedure. Two team members earlier had spotted an immature California condor feeding nearby. Anticipating the bird's return we prepared the trapsite—a calf carcass tied downwind of a 50 × 50-foot capture net. The net was designed to be carried over the feeding condor by four metal projectiles fired from cannons carefully positioned and camouflaged. The cannons were electrically detonated from a blind hidden 75 feet away.

Under our federal permit, the net could be fired over only an immature condor; if we also caught an adult, it would have to be released after we had taken a blood sample and had attached radio transmitters. We would draw a blood sample from an immature bird and then place it in a large airline travel kennel pending determination of its sex, a task that takes 35 to 40 hours and is done using blood cultures. If the captured immature turned out to be a male, he would be released with radio transmitters attached to his wings. If we captured a female, she would be taken to the Los Angeles Zoo where she would be paired with a 15-year-old male named Topa Topa.

At the trapsite, team biologists concealed themselves on a distant ridge where they could monitor the skies and the condor's movements when it came to feed on the carcass. Meanwhile Noel Snyder, Pete Bloom, and I hid in a blind near the bait. We communicated with the ridge by two-way radio.

Early on the morning of the capture, final preparations were completed and we entered the blind. Within an hour the hilltop observers saw condors soaring. At 11:06 a.m. a mature female golden eagle landed on the carcass and ate. Forty-five minutes passed and an immature male eagle joined her. More eagles arrived and departed with full crops. This activity was welcome. It might lure a condor.

At 3:10 p.m. we received a radio communication that an immature condor was nearing the trapsite. Then the words "condor dropping" had our hearts pounding. The sight of the bright pink area on the gray neck was incomparable. The head lacked the complete

4) Condors eat only carrion. 5) Biologists check transmitter before release. 6) Sisquoc and Teewya, first chicks hatched at San Diego Zoo.

orange-red pigmentation of an adult, yet it didn't have the grayish stubble-feather appearance of young juveniles. A plume of fine black feathers surrounded the base of the neck. The bird was three or four years old. A perfect specimen. A golden opportunity.

The bird landed 75 feet from the carcass. There were still two eagles on the bait. Before departing, one eagle made a harassing pass at the approaching condor. The remaining eagle continued to feed as the condor stalked the bait. The condor gave the eagle room but moved closer. After a few moments the condor rushed the eagle and forced her off. As the condor stood feeding we remained poised until the eagle cleared the target. The condor lowered its head to feed. Three. Two. One. I depressed the automatic motor drive button on my camera. Zero. The net shot over the great bird. Pete Bloom was already out of the blind, sprinting toward the trapped bird. I was two steps behind and together we held our precious captive for the seven minutes it took for the rest of the team to arrive.

We examined the bird and found it free of injury. With the condor carefully positioned on its back we drew a blood specimen, then weighed the bird and placed it in the sky kennel. It took 23 minutes from the time the net was fired until the bird rested quietly in the kennel. We were pleased.

At 4:30 p.m. Dr. Snyder began the four-hour drive to the San Diego Zoo with the blood samples. From there they were sent to investigators around the country for DNA evaluation, heavy metals analysis, blood parasite screening, and other studies. Of immediate concern was the sex of the condor. While we waited for the test results, the bird was held in a remote location where it was undisturbed.

. . . this life form may cease to exist within 10 years

At 11 a.m. two days after the blood sample arrived we learned that the condor was a male.

The following day at 8 a.m. a transmitter with a tag was placed on each of the condor's wings in a manner similar to that of a person with pierced ears wearing earrings. The mounting procedure took one hour. The bird displayed no sign of fatigue or stress. After we returned him to the sky kennel, we were one step closer to release. We were all looking forward to returning him to the wild and were on a schedule that permitted release close to noon, when the air currents are best for soaring.

Precisely at noon two team members carried the sky kennel to a knoll near where the condor was captured. Several miles away a Cessna 180 with two biologists aboard monitored the bird's radio signals from the air; two more team members monitored them from the ground.

The biologists placed the kennel on the ground, opened the door and stepped back. The condor walked out, took a few steps and spread his wings. I could barely see the white four-inch identification tags under his expansive wings.

The second largest flying bird in the Western Hemisphere (after the Andean condor) was free again. Cheers went up, but briefly, for the monitoring equipment required attention. As the condor flew into the distance, I could think only about the fact that this life form may cease to exist within 10 years.

Much more work needs to be done.

POSTSCRIPT

In the two years following this achievement, 12 eggs have been taken from wild condor nests. All the eggs proved to be fertile and were hatched by artificial incubation. Ten of the chicks survived, raising the total captive population to 15. From this group as many as three will be released in 1985 to join the wild population now numbering 16.

Also important has been the information on habitat gathered by following two condors wearing radio transmitters in the wild. The condor whose capture and release were discussed above was found dead on March 22, 1984. Postmortem examination and subsequent investigations indicate that his death was caused by lead poisoning from ingestion of a lead bullet fragment probably acquired from feeding on a carcass which had been shot.

The death of this special bird was indeed a loss. By radio tracking him, we have learned valuable habitat and behavioral information. He will be missed.

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Photographs: *Previous page:* Tom McHugh (Photo Researchers, Inc.). *Above:* photographs one through five by Philip Ensley; photograph six by Ron Garrison, Zoological Society of San Diego.

That Divine Impulse

Janet M. Williams

LAND BIRDS have been recorded flying over the oceans since 1498 when Columbus sighted songbirds 180 miles off Trinidad on his third voyage to the new world. John Hurdis, a naturalist in Bermuda in the mid 1800s, writes of Samuel Nelmes on board the *Carib* on September 14, 1833. Sailing 300 miles east of Bermuda, Nelmes fell in with endless flocks of plovers all flying in a southeast direction. In another account Hurdis mentions Elwin Jones, the master of the O. G. *Bigelow,* meeting hundreds of flocks of plovers passing southward over the vessel on September 11, 1846.

Hurdis wrote, "How wonderful must be the power of flight, thus to enable mere land birds to make the ocean their highway from one region of the earth to another, without food, and without a resting place! More wonderful still, that divine impulse under which these feathered legions move, and by which they are guided across this immensity of open sea at the appointed time." These reflections summarize what brought my husband Timothy and me to study the migrations of land birds over the open oceans.

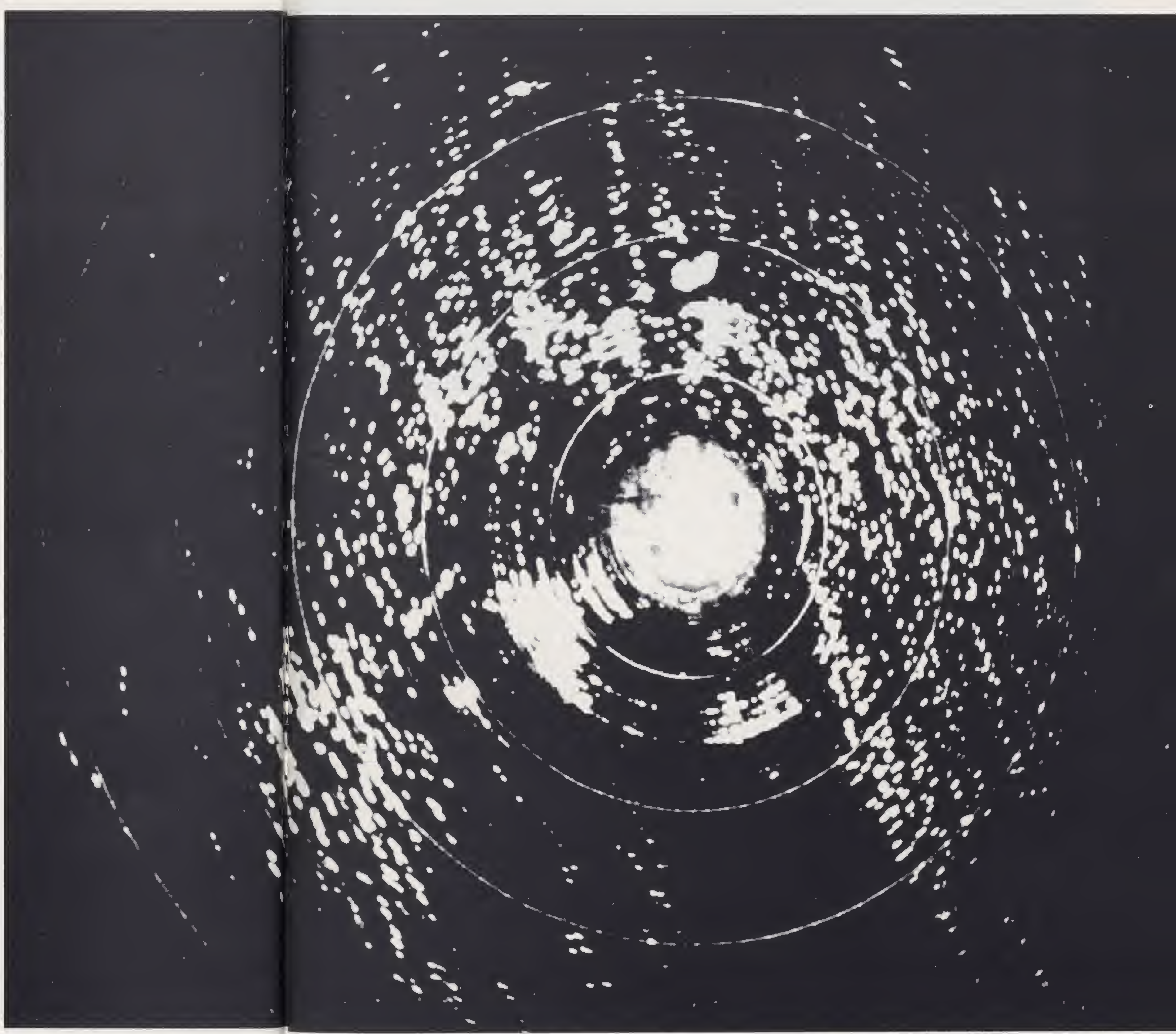
There are many techniques for studying bird migration: some are good for long-distance migration, some for short, and others are effective only during the day or at night. Each reveals a different aspect of migration, and all must be combined to form a complete picture. One of the most valuable methods is to make detailed visual observations every day at the same site. By doing this the observer can watch for flocks moving through an area and can estimate the total number of birds in that area each day.

A second technique is banding birds. Individuals can be caught in nearly invisible mist nets, catalogued, banded with a numbered band, and then released. If someone finds and reports the bird at a later date, the bander can tell how far it has flown before being picked up. Some birds have been banded in Alaska and later found as far away as South America, the South Pacific islands, or New Zealand. But, since only about 1 percent of banded birds is recovered (perhaps up to 10 percent in waterfowl), a tremendous number of birds must be banded to get a significant amount of data.

Another technique used in studying bird migration is radio telemetry. A small transmitter is placed on a bird, and the radio signals of the flying bird are picked up by receivers and directional antennae placed on cars, boats, or airplanes. This method of tracking works especially well if the equipped vehicle can go where the bird is flying, and if the police, coast guard or air traffic controllers have been notified of the experiment.

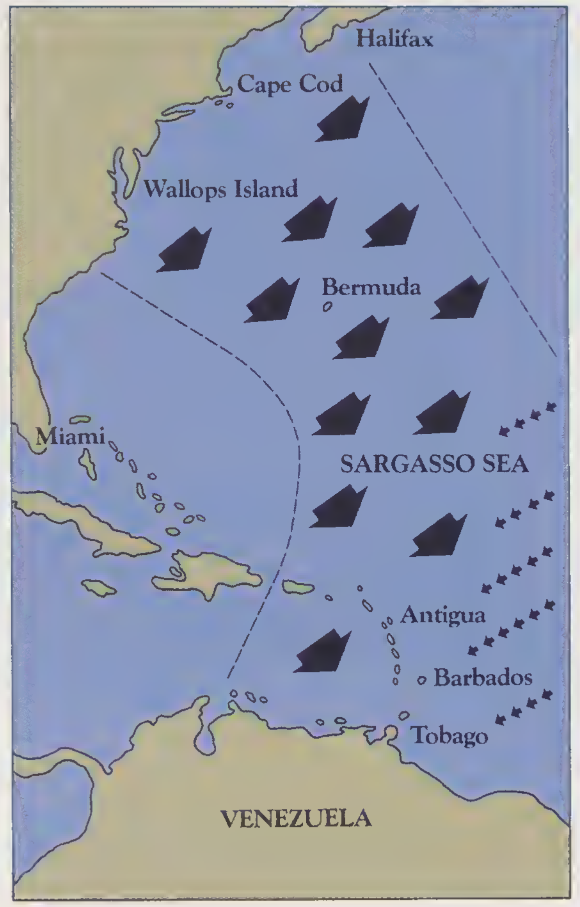
Using a ceilometer is a way to look at birds migrating at night. A ceilom-

The dots became known as angels because no one could figure out what they were



Fall bird migration as seen on the radar screen at Bermuda. Photograph by Leonard C. Ireland.

KEN BRAT (PHOTO RESEARCHERS, INC.)



The first birds to leave in fall are the shorebirds. Among those that may take an overwater route are sanderlings, far left. Map shows pattern of overwater migration in western North Atlantic. Large arrows show direction of southeastward migration of land birds. Small arrows show northeast trade winds.

> **In many cases birds flying over the ocean are taking advantage of strong favorable winds**

eter is a powerful source of light which is pointed up into the night sky. Lying on your back and looking along the light beam with binoculars, you can count the birds flying through the beam. Also with the use of binoculars, you can count the birds crossing the face of the moon on nights when the moon is full. These techniques are good for detecting numbers of migrants in a given time period and the direction of flight, but identification of individual species is difficult. Also, this technique is effective only to about 1,500 feet of altitude, and the speed of flight cannot be determined.

Radar, which can detect nearly any object moving or stationary, is another effective tool for studying bird migration. Both search radar, which detects large numbers of objects, and tracking radar, which follows a single object, such as one bird or a flock, can be used. Timing, height, direction, speed, and density of migration can be obtained by using radar. In addition, radar can follow birds at distances of up to 180 miles. All this sounds almost too good to be true; the hitch is that we cannot tell the species of bird which appears on the radar screen.

In the 20 years Timothy and I have been studying the movements of bats and birds, we have used nearly all of these techniques. Our more recent work has used radar and detailed visual observations to study land birds migrating over the oceans. This work started in the western North Atlantic using a network of National Aeronautics and Space Administration (NASA), Federal Aviation Administration (FAA), and weather radar stations in Halifax, Nova Scotia; Cape Cod, Massachusetts; Wallops Island, Virginia, Miami, Florida and on the islands of Bermuda, Antigua, Barbados, and Tobago. Our ninth radar station was on board a vessel out of the Woods Hole Oceanographic Institution in Massachusetts. By using nine radar stations simultaneously, we were able to make observations along the eastern coast of North America and in the western North Atlantic during the fall migration season for six consecutive years.

During World War II, when radar was first used, a lot of little white dots were seen on radar screens which the operators knew were not airplanes. For one thing, the dots did not move as fast as airplanes, and sometimes masses of them would cover the screen. The dots became known as angels because no one could figure out what they were. In England in the 1950s, David Lack and Eric Eastwood showed that many of these angels were birds.

Here in the United States in the late 1950s William Drury and Ian Nisbet of the Massachusetts Audubon Society were using radar to look at birds leaving the Cape Cod coast. By the late 1960s, when we first started this research, getting permission from government agencies to use radar for bird and bat migration studies was not really a problem. But convincing radar operators that what we were doing was valid was a different matter, despite the fact that by this time radar had been used to study birds.

We knew that flying animals could be detected on radar because we had completed a study for the United States Air Force which was trying to divert training jets away from flocks of bats a million strong. We became curious as to where birds went every fall after they left the east coast of the United States and Canada. By using radar we saw that they were heading out over the Atlantic Ocean in flocks so dense that on some nights they appeared as a mass of white. We noted with interest that the birds were heading southeast over the open ocean. Radar operators at the NASA Station at Wallops Island, Virginia finally realized they were seeing birds when one evening, as we were tracking a large target with radar, they picked up the object with their spotting scope; it was a great blue heron.

The operators became as interested as we in learning where the birds were heading. Did they go out over the water and then turn back toward the coast before getting to the Caribbean? Did they fly over the water and then disappear and die? The operators even encouraged us to go to Bermuda where we could watch for birds on other NASA radar screens.

Amazingly, the first thing we saw when we arrived in Bermuda on a crisp October day was a small flock of great blue herons. Had we followed them or had they followed us? Either way, we discovered from our radar observations that the migrant birds were still heading southwest over Bermuda and, for the most part, not landing on the island but continuing over the Atlantic. Since there are no more islands southeast of Bermuda, we had to figure out where next to look for these southeasterly bound migrants. We considered two possibilities: go to the islands of the Caribbean, or onto a ship that could get us east and south of Bermuda. We decided to try both.

The next four fall bird migration seasons found us on three Caribbean islands. Our coworkers Len Ireland and David Wingate were on Bermuda; and John Teal, Don Griffin, and Ron Larkin were in the western Atlantic on ships from Woods Hole. We continued to find migrating birds and cooperative radar operators everywhere we went. People were getting used to seeing birds on radar and our goals no longer seemed bizarre.

From our radar observations and those of John Richardson in Canada, we learned that migrant birds take off from the northeast coast of North America heading in a southeasterly direction. The birds leave the coast after sunset following the passage of a cold front, when skies are clear and northwest winds are strong. The winds help to carry the birds out over the Atlantic Ocean, to Bermuda and beyond. The birds continue to head southeast until they reach the area of the Sargasso Sea where they encounter strong easterly trade winds that blow them back toward the Caribbean and South America.

The data collected on the ships and on Antigua enabled us to discover much about the directional patterns of birds migrating over the ocean. Eventually we went beyond Bermuda to find the pattern of land bird migration over the western Atlantic. We got information on wind directions at each radar site from weather balloons. Comparing these data with the migration directions seen on radar helped us to put together a pattern of migration of the birds in flight. We estimated the time it takes birds to fly from Nova Scotia to the Caribbean, a distance of about 2,000 miles, to be about 80 hours. To reach Venezuela takes 88 to 100 hours. These calculations are based on how long it takes waves of migrants to fly from one radar station to the next.

At most stations we also were able to determine the altitude at which the birds were flying. At Bermuda the majority of birds had gained an altitude of about 8,000 feet above sea level. At Antigua they flew as high as 20,000. South of Antigua the birds must have been preparing to land on the southern islands and on South America, because at Barbados they had dropped to about 10,000 feet and by Tobago, just off the coast of South America, they were down to less than a thousand feet.

Since we cannot identify the species of bird from radar information alone, we had to make visual observations throughout the period of a radar study. We cannot expect the species of birds that are on the ground or passing ships during migration to be exactly the same as those flying thousands of feet overhead. Birds on the ground, however, are a measure of what is migrating, as some migrants occasionally come down for food and rest.

Over the ocean, land birds are not able to sit on or feed from the water. Large flocks of land birds are often seen or heard from ships, as mentioned by Hurdis. Occasionally, tired and hungry birds will land on ships, especially during a storm, as we know from our colleagues on the ships from Woods Hole. The birds which most often land on ships are warblers and sparrows. Usually they do not have the energy to fly on, and many die in the ocean.

WAYNE LANKINEN (BRUCE COLEMAN INC.)

Ruddy turnstones may travel 2,000 miles, flying more than 80 hours nonstop, during fall migration.

Visual observations from ships are not limited to occasional large flocks. Individual birds also fly past the ships without stopping. We kept track of these on a daily basis, noting when and where they were seen and in what direction they were going. One of our coworkers, Carol McClintock, even tried to lure some of these birds to the ship with bits of food and water and by playing recorded bird songs, but most were not interested. In many cases birds flying over the ocean are taking advantage of strong favorable winds. This can be a great benefit to the birds and perhaps outweighs the disadvantage of a long overwater flight without food or rest.

Making daily visual observations on land is also of great importance in migration work. It is important to pick the appropriate habitat for each species that might be migrating through the study area: for example, looking for shorebirds on mudflats and along rocky shorelines, for ducks in the right kind of lake, pond, or saltwater inlet, and for passerines in a forested area, thicket or grassland.

This is not as easy as it sounds, and once the appropriate place has been found, the researcher must show up at the same time or tide every day regardless of weather. In addition you need permission from the landowner and have to look out for other species that might share the habitat. I will not soon forget the time I was counting shorebirds on Tobago and a water buffalo decided my two sons and I were in her territory and wanted us out. She made her point by butting our car and chasing us, and the only reason we got away was because I was convinced that I could out-drive her in our rickety old rent-a-car which I managed to do to Robert's and Peter's cheers.

In our Atlantic study the radar data showed that millions of birds were flying over the water and taking the ocean route during their southward fall migration. The radar cannot tell us what species of bird we are seeing, but banding studies and visual observations suggest that the overwater route may be a favored one for numerous birds.

Different kinds of birds migrate at different times during the migration season, and thus by knowing what month it is, the researcher has some knowledge of what species are migrating without ever seeing a bird. The first birds to leave each fall are the shorebirds. Among those that could take the overwater route are semipalmated plovers, American golden plovers, black-bellied plovers, ruddy turnstones, red knots, whimbrels, least sandpipers, semipalmated sandpipers, Hudsonian godwits and sanderlings. In no way is this list complete, nor do I mean to imply that all members of a species take a particular route; some members of a species might migrate over water and others of the same species might migrate over a more land-based route. At present we do not know what makes some birds, even within the same species, choose one route over another.

The next group of birds to migrate each fall is the passerines. Of these, some overwater migrants might be barn swallows, prothonotary warblers, blackpoll warblers, northern waterthrushes, American redstarts, and bobolinks. During this same period ospreys and peregrine falcons might also migrate over the ocean. The latest migrants of the season are the waterfowl. Of these green-winged teals and blue-winged teals are probably overwater fliers.

We were very excited to learn there is a pattern to migration over the western Atlantic Ocean, and to learn which species of birds might take this overwater route each fall. Timothy and I are now studying migration over the Pacific Ocean to discover whether there are global patterns to overwater migration, and to determine the capabilities of the birds making these vast flights.

FURTHER READING

Baker, Robin. *The Mystery of Migration.* Viking Press, New York. 1981.

Fisher, Allen C., Jr. "Mysteries of Bird Migration." *National Geographic.* August, 1979.

THE AUTHOR

Janet Williams is a research associate at Swarthmore College, Swarthmore, Pennsylvania.

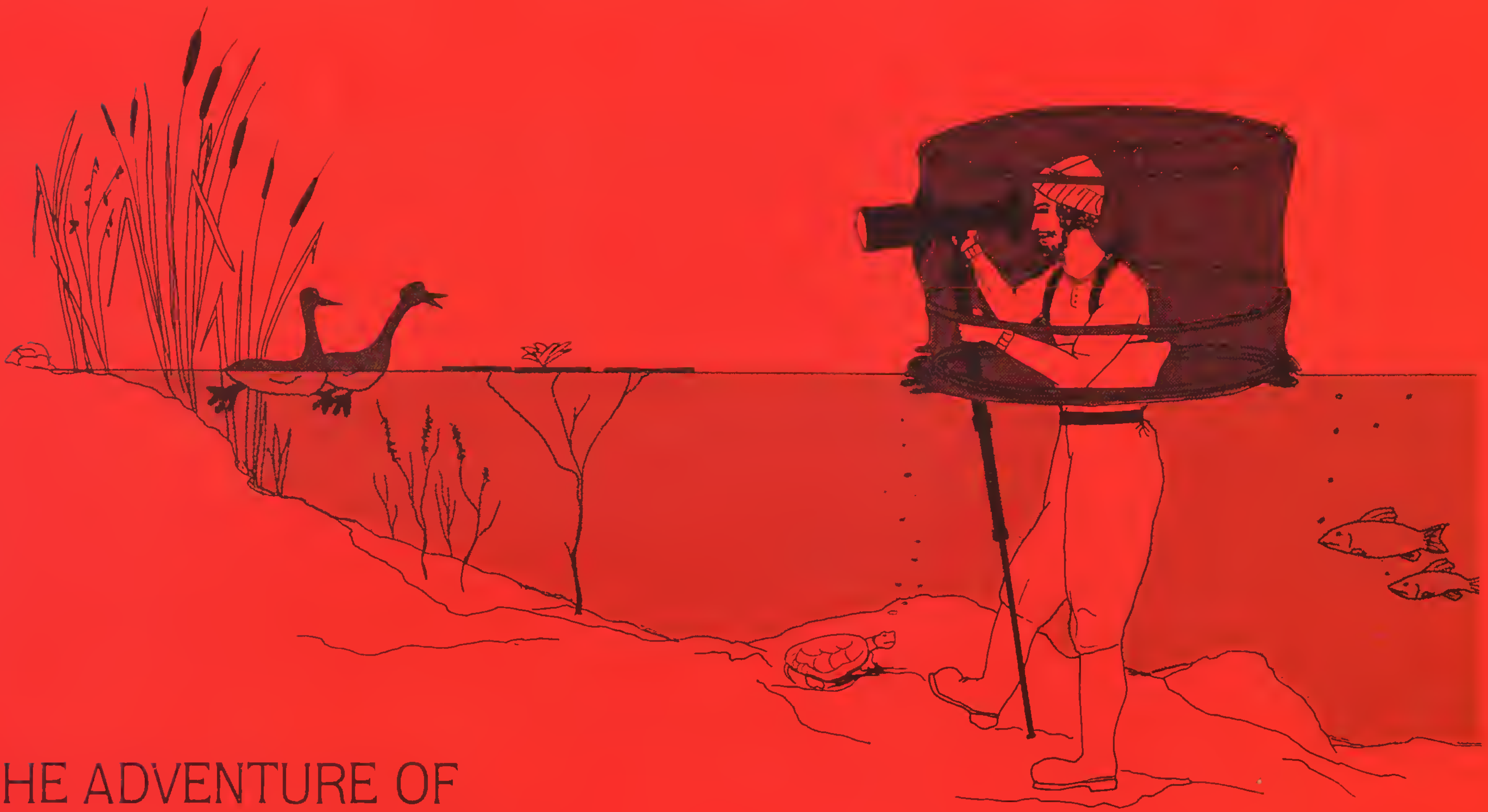


Figure 6
Using the Mobile Blind

THE ADVENTURE OF NATURE PHOTOGRAPHY

TIM FITZHARRIS

Down-to-earth guide that unravels the complexities of nature photography. Text and photographs explain how to take creative photographs. Included are camera and accessory descriptions, techniques, tips on attracting animals, and everything from the principles of composition to stalking.

1983, paper, 216 pages.
$19.95/$17.96 members

BIRDS OF TROPICAL AMERICA

ALEXANDER F. SKUTCH

A blend of the poetry and science, the beauty and charm of birds. Thirty-four tropical species—from toucans and motmots to puffbirds and quetzals—are explored in intimate detail.

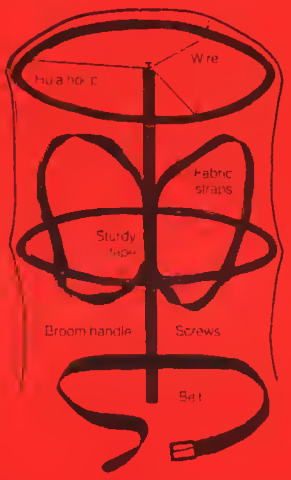
1983, cloth, 305 pages.
$29.95/$26.96 members

BIRD SOUNDS AND THEIR MEANING

ROSEMARY JELLIS

An accurate and lucid guide for the nonspecialist, hailed by many as the best introduction to the subject. Chapters include dialects, songs, moods and events, copies and counterfeits.

1984, paper, 256 pages.
$14.95/$13.46 members



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Enclosed is a check or money order in U.S. funds, payable to The Crow's Nest Bookshop. Our address—The Crow's Nest Bookshop, Laboratory of Ornithology, Cornell University, Sapsucker Woods, Ithaca, N.Y. 14850. (607) 256-5057.

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Great blue heron striking

Decisive Moments

Photographs and text by Tim Fitzharris

AGAIN I AM AWAKENED by the hum of a mosquito inside the cramped quarters of the blind. Blotting sweat from my eyes with a dangling shirttail, I peer through the long tunnel of lens into the white heat of the Saskatchewan prairie.

The nest platform is empty. The four young harriers are scattered into the relative coolness of the surrounding cattails and remain still except to snap occasionally at a passing horsefly. Like me they wait for the return of the hunting mother. During my two days of photography at the nest she has airlifted over 30 mice and voles to the ravenous brood.

Another half hour passes before her plaintive cry floats in from the prairie. Immediately the young converge on the nest, staggering through the tangle of stems in their eagerness to be fed. They huddle together. Four pairs of eyes trace a circle in the sky and suddenly the big bird of prey drops into my viewfinder. A tense, frozen silence takes over as her blazing eyes survey the blind. I dare not breathe. Finally her fierce gaze shifts to the swaying, expectant hawklets. Lunch begins. Cautiously I start to work the camera.

My experience at the harriers' nest is typical of my photographic encounters with birds. Most of these adventures entail hard work, patience, and a good measure of heart-thumping excitement. Probably less than half of them result in worthwhile pictures.

Bird photography carries its own rewards. It's a reason to explore new areas, experience the wilderness, and observe animal behavior seldom seen by others. It's a challenge to capture wild and unpredictable subjects on film. Attractive though all this may sound it does not keep me trudging into the bush year after year in search of a bird. I don't like to get wet or cold or to walk on bumpy ground. My greatest pleasure and motivation is the anticipation of seeing the finished photographs.

Soon after I became interested in bird photography I discovered, much to my disappointment, that practically all of North America's species had been photographed. There was nothing left for an energetic young lensman to photograph. I was not discouraged for long. I quickly realized that earlier photographers had paved the way for me to take a freer approach. They had been charged with the necessary but dry task of taking the "for the record" shots, the pictures needed to prove that a certain bird exists, that it has two wings and a beak, that it will be filed henceforth under "Aves." This state of affairs led me to an early decision—if I were going to photograph a bird, I would try to do it in a different and artistically significant way.

My intention was typical of a serious photographer. But I soon found out that birds, or any wildlife, are not easy subjects for creative photographs. Birds cannot be directed like a human model or provocatively arranged like fruits in a bowl. As subjects they can be controlled only indirectly. Despite this drawback, birds continued to maintain a strong hold on my imagination and photographic energies. As my files of bird slides grew bulkier each year, I gained an understanding of what I liked about my own pictures and bird photographs in general. I discovered that a number of procedures and techniques are crucial to the success of my work.

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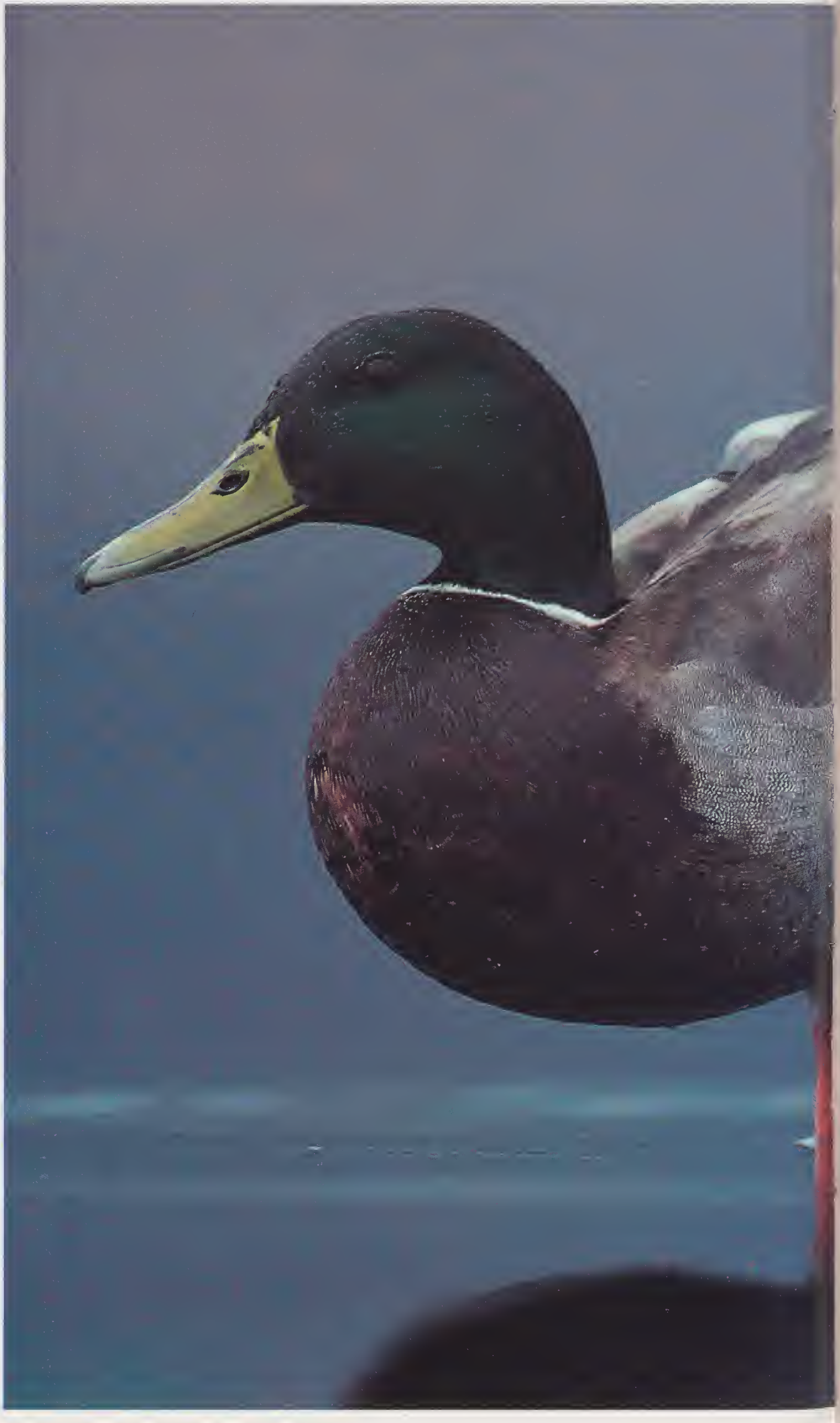
Mallard stretching



BIRD BEHAVIOR

Successful bird photography begins with an understanding of the behavior of the bird itself. Such an understanding allows the photographer to predict and even direct bird activity to his advantage. Two aspects of behavior are most significant to the photographer—food procurement and the reproductive cycle. Each of North America's 835 species has a unique way of carrying out these activities. It's not possible for a photographer to keep this information in his head. However a general knowledge of these aspects is required, as well as familiarity with a species' life history.

LIGHTING

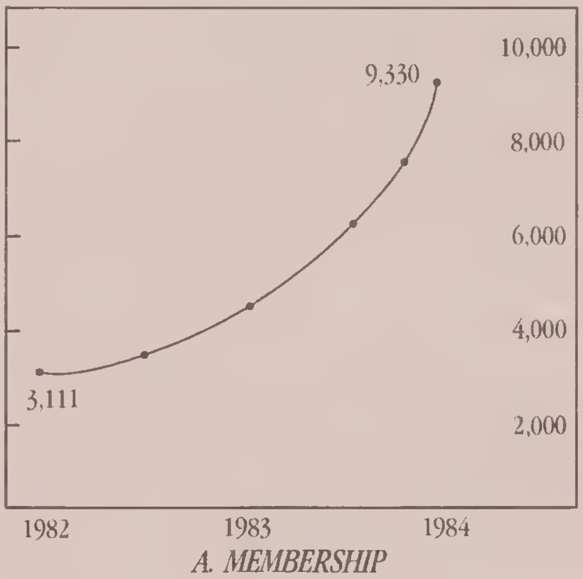
Novice bird photographers direct too much attention to choosing a subject, lens focal length or camera angle, and not enough to developing an awareness of how light affects the image. Gaining a sensitivity to the special photographic qualities of light is not difficult, but it requires a shift in everyday habits of perception. Conscious effort and practice are necessary to see the light that reflects from the subject rather than the subject itself. Photographers need to train themselves to notice such features as the shadows on the underside of a prairie falcon's beak or the reflective properties of a blue jay's plumage. Most books on photography deal with this subject.

DON'T LEAVE HOME WITHOUT IT

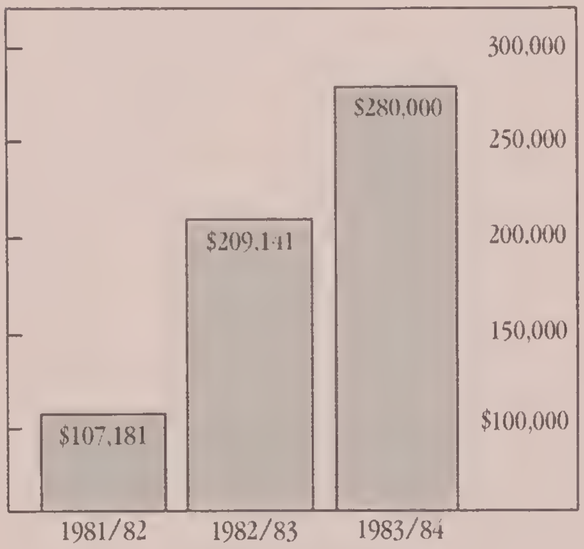
For me it's almost as important to place a tripod beneath the camera as to put film inside it. It is difficult to achieve maximum sharpness unless the camera is rock steady during exposure. Since birds are so colorful and intricately structured, every precaution should be taken to ensure that none of this beauty is lost because a shaky camera produced fuzzy images. Further, the small size of the average bird often calls for the use of telephoto lenses making a tripod even more important. Aside from the technical advantages, a tripod requires more

Cornell University Laboratory of Ornithology

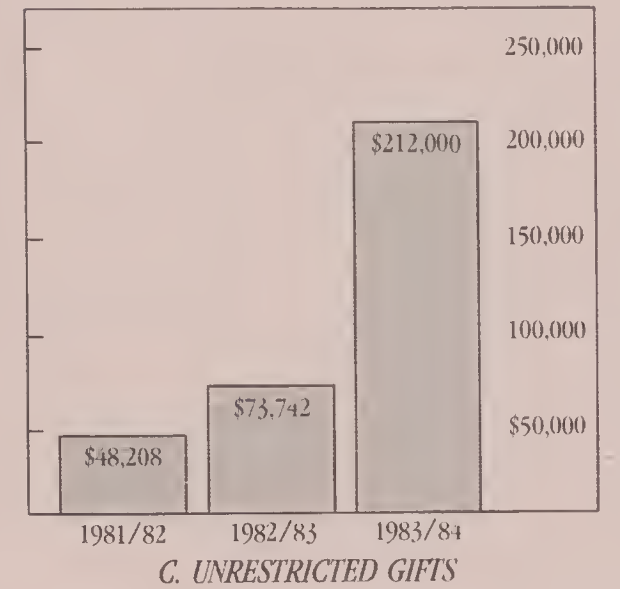
ANNUAL REPORT 1983/1984



A. MEMBERSHIP



B. MEMBERSHIP INCOME



C. UNRESTRICTED GIFTS

LETTER FROM THE DIRECTOR

In the following few pages I want to share with you some of the exciting news in research and education here at the Laboratory. This letter serves as our annual report, and provides a summary of the highlights of the past year.

First, though, I'd like to draw your attention to the charts on the left. They reflect the Laboratory's unprecedented growth in membership and gift income. A year ago our membership was about 6,200, up from 3,400 in July 1982. This year we have been averaging about 300 new members each month; in the summer of 1984 our membership approached 9,500. Chart A shows this growth, along with the impact of the direct-mail campaign we began in early 1983.

Charts B and C illustrate two of the effects of our surge in membership. Membership income is up, which means that we are able to maintain the quality of our membership services even as the demand for them grows. Unrestricted gift income has nearly tripled, from about $73,000 last year to over $210,000 this year. Most of these gifts, ranging from $5 to $50,000, have come from members.

As our base of support broadens, the quantity and the quality of our research and education programs increases. And, as these grow, our enhanced visibility enables us to attract more members and supporters. Thus there is a direct connection between membership and gifts and the success of our programs.

I would like to take this opportunity to thank you, the Laboratory's members and donors, for supporting our research and educational endeavors. Without your encouragement, much of our work would not be possible.

Seatuck

Seatuck Research Program's survey of least terns and piping plovers on Long Island, conducted in cooperation with the New York State Department of Environmental Conservation, has had two exciting developments. The survey has been expanded to include all species of terns and skimmers nesting on Long Island, and has led to the establishment of the Long Island Colonial Waterbird Association, a consortium of environmental groups dedicated to preserving and managing the endangered least terns and piping plovers.

Using radio collars and receivers, Seatuck researchers have been tracking white-tailed deer in an effort to understand their ecology and behavior in the suburban habitats of Islip, Long Island. In a related project, a breeding bird population survey is being conducted in 10 areas of Islip, correlating population trends with vegetation and the amount of construction in each area. The aim of the survey is to gather enough information to make recommendations to planners and landscapers who are considering building in the region.

With funding from the New York City Audubon Society, Seatuck researchers are conducting a study at Floyd Bennett Field, Gateway National Recreation Area, in Brooklyn. The information they collect will help to formulate an ecological management plan for the abandoned airfield.

At the Seatuck Wildlife Refuge itself, the ospreys have nested for a second year, and an immature pair has engaged in frustration nesting, indicating that the birds are likely to nest in 1985.

Perhaps the best news from Seatuck is that in June the program received six more years of funding. This represents a vote of confidence in the program and Director Tom Litwin, and is a great boost for the projects now under way. Laboratory board member Charles Webster has continued to be instrumental in securing funding for the Seatuck Research Program.

Cooperative Research

During the past year staff members of our Cooperative Research Program (CRP) have spent much of their time compiling and analyzing data on the seasonal distribution and reproductive success of many species of North American birds. In particular, they worked closely with biologists from the U.S. Fish and Wildlife Service's Office of Migratory Bird Management and the Patuxent Wildlife Research Center comparing distribution and population sizes of two dozen species of colonially nesting sea and wading birds.

Biologists from CRP's Colonial Bird Register helped lead special efforts to survey and protect colonially nesting birds in North Carolina during the summer of 1983. Also, in cooperation with the National Audubon Society, the CRP analyzed data on populations of wood storks in Florida. Our findings contributed to the recent decision to list wood storks as an endangered species.

A contribution from the Bird Friends Society of Essex, Connecticut, a non-profit organization dedicated to the preservation of America's wild birds, will enable CRP to continue studies on eastern bluebirds. We will be expanding upon studies by David Peakall, published in *The Living Bird,* concerning habitat, productivity, clutch size, and the length of the breeding season for this disappearing species.

Researchers from institutions and agencies throughout the United States requested data from CRP's Nest Record Program for a variety of species during 1983: red-winged blackbirds, whip-poor-wills, robins, white-crowned sparrows, merlins, bald eagles, Canada geese, and a few species of owls. Several state bird atlas programs used NRP information to confirm breeding records.

Every year thousands of amateur ornithologists collect enormous amounts of data through Christmas bird counts. Much of this information is useful in studying the distribution and abundance of wintering birds, but currently these data are not in an accessible form. A new project planned for CRP would computerize these data, making them easier to analyze and far more valuable to biologists.

Now that the National Audubon Society has stopped funding the Cooperative Research Program, the Laboratory is seeking ways to finance the program. We have written an informational white paper which describes the purpose of cooperative research, its place in American ornithology, and our plans for making the program a center for the study of bird populations. We will be happy to send you a copy upon request.

Library of Natural Sounds

The year was one of important accomplishments for the Library of Natural Sounds. A comprehensive, detailed review of LNS's programs was carried out by a panel of distinguished ornithologists and behavioral biologists, including Crawford Greenewalt, Wesley Lanyon and William Conway. In a report to the Laboratory's administrative board at its April meeting, the committee proposed the development of a research component for LNS which will enhance its position as the preeminent animal sound collection in the world.

During the year, LNS completed the fifth and last year of National Science Foundation support. A new proposal was submitted which included funds to refurbish the studio and equipment and to assist with curatorial salaries for a three-year period. Although final action on the proposal is not complete, we anticipate continued NSF support. This, coupled with implementation of the review committee recommendations, will ensure vigorous development of LNS's programs.

Last November, the revised edition of *A Field Guide to Bird Songs of Eastern and Central North America* was published by Houghton Mifflin Company in record and cassette form. LNS prepared master tapes for the new edition and supervised all stages of the production of the new records and cassette tapes. Included are 246 species, with a concentration on birds for which sound is important in identification. The examples are much longer than on the earlier edition and provide a better resource from which to learn bird songs. The new Peterson guide complements the bird song guides that LNS prepared in the preceding year to accompany the National Geographic *Field Guide to the Birds of North America.*

LNS has almost completed a new edition of the classic *Warblers of Eastern North America* by William Gunn and Donald Borror. This edition includes all species found north of Mexico and sets new acoustic standards for such publications.

Peregrine Program

In the spring, Scarlett, a Cornell-bred female peregrine falcon, and Beauregard, an unbanded wild male, raised four young on a 33rd-floor ledge of a Baltimore office building. These were the first peregrine chicks known to have hatched on a skyscraper in eastern North America since the early 1950s.

Peregrines nesting successfully again on New York's Verrazano Narrows Bridge and Throgs Neck Bridge were among the most visible accomplishments of a nesting season that saw the number of successful pairs in the east double from 10 to 20. The captive breeding programs in Ithaca, New York, Fort Collins, Colorado, and Santa Cruz, California accounted for 300 young peregrines this year.

In May the site of the new World Center for Birds of Prey was dedicated in Boise, Idaho. The center will house The Peregrine Fund's headquarters and its Rocky Mountain recovery program, along with projects concerned with other birds of prey.

In addition, Tom Cade, director of The Peregrine Fund, received this year's Gulf Oil Conservation Award which honors Americans who have made outstanding contributions to the preservation of renewable natural resources.

Pigeon Navigation

We have spent the past few seasons exploring how pigeons use the Earth's magnetic field to find their way home. In past experiments, where magnets were glued to pigeons, it was found that when the sun wasn't shining the birds became disoriented. This led us to suspect that pigeons use the Earth's magnetic field as a compass when the sun is not visible.

We also found that pigeons are disoriented when released at magnetic anomalies—places where the Earth's magnetic field is disturbed by iron deposits. Two things are interesting about this: disorientation occurs under sunny skies, and the disturbance of the Earth's magnetic field at an anomaly is very small. Both these findings make us think the anomalies are upsetting not the birds' magnetic compass, but some other component of their position-finding system.

But these findings raise more questions. Because the iron-rich rock at anomalies is denser than normal rock, magnetic anomalies have slightly stronger gravity. To see what effect this had on the pigeons, we released them from salt domes in Texas where the gravity is anomalous but the magnetic field is normal. The pigeons oriented and homed normally; therefore, it is probably the weak distortion of the magnetic field at anomalies that causes the disorientation.

Another question puzzles us. Last summer we released Cornell pigeons from a magnetic anomaly north of Ithaca, New York. All the pigeons were well oriented and homed normally. This result is a total surprise—pigeons from our Lincoln, Massachusetts lofts were always disoriented at anomalies and the same result has been found in Ohio, Switzerland, and Germany. We are now going to determine whether the problem is with the anomaly or, for some mysterious reason, with the Cornell pigeons. We'll do this by releasing the Cornell pigeons at another magnetic anomaly in Massachusetts; if the birds are disoriented, it will suggest that the problem is with the New York anomaly. If they fly straight home, we'll know that the difference is the Cornell pigeons. We can't wait to find out.

Public Education

This year *The Living Bird Quarterly* was cited for "exceptional achievement" in the annual recognition program of the Council for the Advancement and Support of Education (CASE). This was the highest award in the professional and specialized magazine category.

The Public Education Program has a new assistant director, Steven Sibley. Steven recently completed a master's degree in zoology from Mississippi State University. He will be responsible for the Laboratory's Library and an assortment of public education projects.

Our radio program, "Know Your Birds," broadcast every Saturday morning over WHCU, continues to be popular with its Ithaca-area audience. This year we have developed a proposal for funding national syndication of a similar program. The proposal is under review by the National Science Foundation.

Enrollment in our correspondence course, "Seminars in Ornithology," continues to grow. To date, over 6,000 students have enrolled. The preface and all nine lessons were reprinted with modest revisions, and references for further readings were completely updated.

During the year three Louis Agassiz Fuertes lecturers spoke at our Monday evening lecture series: artist Donald Eckelberry on aesthetics in relation to ornithological painting; Alan Kemp on the biology of African hornbills, and David Nettleship on the reproductive strategies of Arctic seabirds. Funding for Fuertes lecturers is provided through an endowment established in 1975 by Olin Sewall Pettingill, Jr. and the late George Miksch Sutton.

Three exhibits of original art were displayed in our galleries over the past year. A show of natural history art by local artists was presented last fall in cooperation with the Cayuga Bird Club of Ithaca. The show was organized by artist Karen Allaben-Confer. "Photographs of Kenya" by David Blanton were shown last winter, and "Birds in Print" by James Coe, most of which appear in the *Audubon Society Master Guide to Birding,* were displayed during the spring. In addition, the Fuertes oil paintings in the Laboratory's Brewster wing were cleaned and restored by the Williamstown Regional Art Conservation Laboratory with funds provided by a special gift from our summer field ornithology class of 1983. Also, three waterfowl decoy carvings by Fuertes are currently on loan for display at the Wildfowl Art Museum of Salisbury, Maryland, and at the 1984 World's Fair Exposition in New Orleans.

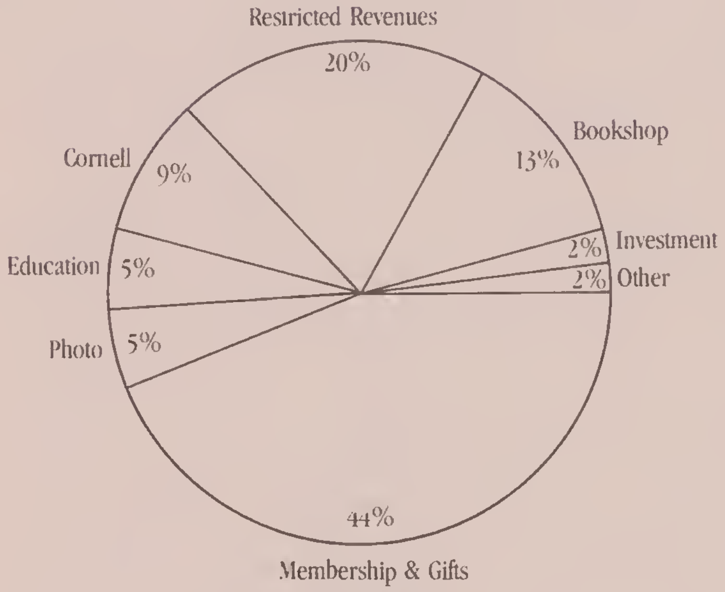
Summer was an especially busy time in public education. Our staff taught or led field trips in a variety of courses and workshops, including Cornell Adult University's popular "Introductory Field Ornithology," the National Wildlife Federation's Adirondack Summit Program, and the Audubon Camp in Maine.

In April a record 100 students enrolled in our six-week noncredit course "Spring Field Ornithology" offered by Stephen Kress in collaboration with Laboratory staff.

As you can see, it has been an exciting year for the Laboratory. Our expectations and energy are high, and the prospects for continued growth—in size and in programs—are excellent. With the support of our members, we will make next year our best ever.

Charles Walcott
EXECUTIVE DIRECTOR

Financial Summary 1983/84



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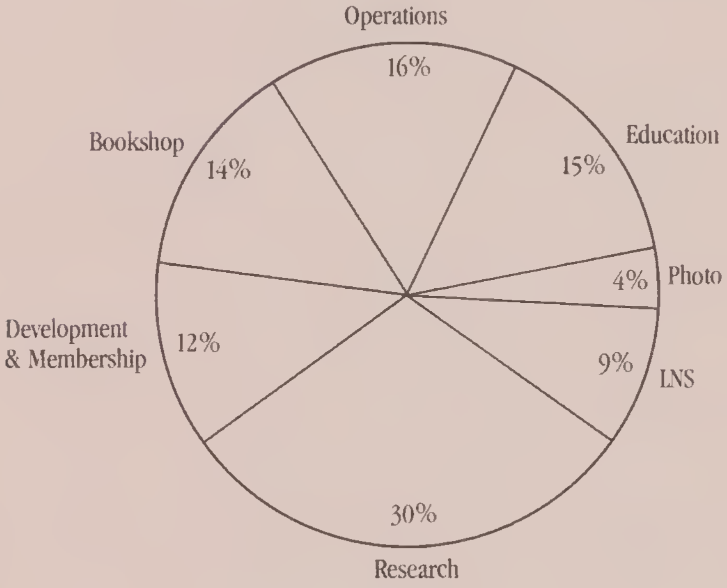

EXPENSES

INCOME

Restricted Revenues	$ 359,412
Membership	276,194
Crow's Nest Bookshop	239,847
Unrestricted Gifts	186,959*
Pigeon Navigation Project	121,866
Library of Natural Sounds	115,063
General Operations	97,904
Public Education	95,069
Photography	94,236
Cornell Contribution	164,774
Other	44,353
Investment Income	30,494
Total Revenues	$ 1,826,171

EXPENSES

Restricted Expenses	$ 359,412
Crow's Nest Bookshop	230,019
General Operations	265,148
Publications	155,625
Library of Natural Sounds	151,844
Pigeon Navigation Project	121,566
Development	116,339
Public Education	94,189
Direct Mail	86,954
Photography	72,367
Total Expenses	$ 1,653,463
Transfer to Reserve Fund	172,708
Balance of Reserve Fund July 1, 1983	(104,574)
Balance of Reserve Fund July 1, 1984	$ 68,134

*Does not include a $25,000 contribution from Cornell University, listed under Cornell Contribution.

BHL

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Northern saw-whet owl mantling

effort to use and thus the photographer gives more thought to image selection and presentation. The viewfinder presents a steady image of the scene, allowing the photographer to analyze the picture as carefully as if he were seeing it on a page of a magazine.

BLIND MAN'S BIRD

Many species of birds are extremely wary. They cannot be recorded unless the photographer conceals himself in a blind. Working inside such a structure the photographer can record the natural and intimate behavior that does not occur in the presence of humans. Also, the photography can be carried out over longer periods of time without causing the animal to become alarmed or take flight. A number of books on nature photography deal with the construction of and procedures for using blinds in bird photography. The photographer should be thoroughly familiar with this information before beginning to shoot. Incorrect methods can endanger the bird and its nestlings.

BACKGROUND & FOREGROUND

I want my photographs to display the same degree of structure and composition as one would see on a painter's canvas. The treatment of the setting is just as important as the bird itself, therefore careful consideration must be given to the background and foreground of the scene. Ideally they should convey some information about the bird or its activities while contributing to the pictorial strength of the image. Camera angle, lens focal length, aperture size (in controlling depth of field), and the camera-subject distance are the photographer's primary considerations when determining the effect of background and foreground.

THE DECISIVE MOMENT

Nothing gives greater power to a bird portrait than when the photographer captures a decisive moment in the life of his subject. A peregrine swooping on a pheasant, a great blue heron striking for a fish or a robin tugging at a night crawler are obvious examples of the dramatic moment. An experienced birder has become aware of the in-

Bonaparte's gulls displaying

stances of irony, humor or pathos in the daily life of a bird—incidents that make compelling, if somewhat more subtle, themes for photographic study. These decisive moments operate on a purely visual level, arising when lighting, color, shape or line coalesce to produce an exceptional image.

How does one capture a decisive moment? The first step—keep your fingers crossed. Luck plays a part. To improve your chances, set up a situation where a dramatic incident is more likely to happen: build a blind where a heron habitually feeds, set out night crawlers in a location that can be photographed readily if a robin shows up.

By learning about bird behavior you can anticipate exciting events and be ready to capture them on film. Eared grebes, for example, rear up and flap their wings just prior to laying an egg. The first time this happened I missed the picture, but the experience helped me to capture the second egg just as it dropped into the nest.

My last recommendation is to shoot lots of film, especially when the action gets fast and furious as when nestlings are being fed or when a courtship display is under way. In such situations I might take more than a hundred pictures. Most shots will be only mildly exciting or will be flawed in some way. But one or two may capture a poignant moment.

I haven't touched on the special techniques or strategies that are an integral part of bird photography. This information can be found in many libraries. In fact, a correspondence course in bird photography is offered by the Cornell Laboratory of Ornithology. Aside from learning the basic principles necessary to safeguard the bird or its breeding cycle, most of this information can be digested as you go along.

As for myself, I'm still learning and in the process getting the wet feet, blisters, chills and thrills that go along with it.

FURTHER READING

Fitzharris, T. *The Adventure of Nature Photography.* Hurtig Publishers Ltd., Edmonton, Canada. 1983.

SAVING BIRDS WORLDWIDE

Roger Pasquier and Thomas Urquhart

From pink pigeons to Mauritius kestrels, the International Council for Bird Preservation coordinates a global effort on behalf of the world's endangered birds.

AT THE TURN of the century, the foremost concern of bird conservationists was the use of plumes to decorate women's hats. Feathers from egrets and tropical birds were sent wholesale to the milliners of London and Paris. The result was the decimation of egret populations in Florida which, in 1896, led to the formation of the first Audubon Society, in Massachusetts. Other states soon followed with their own Audubon Societies, and these were loosely linked into a national organization.

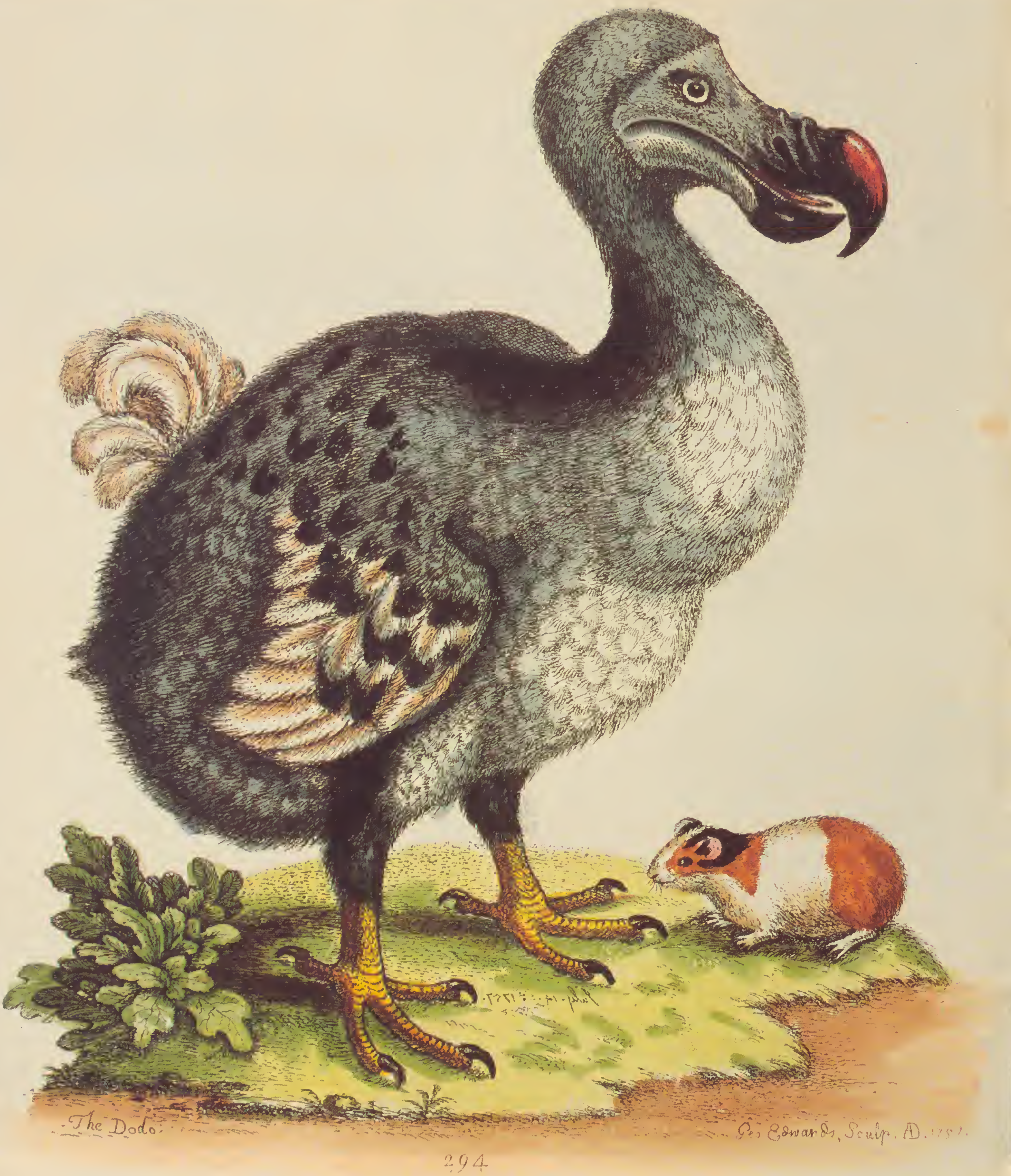
Two decades later, conservationists turned their attention to the loss of migratory birds, especially waterfowl, from indiscriminate hunting. The president of what then was called the National Association of Audubon Societies was T. Gilbert Pearson. He realized that birds disregard political boundaries and that bird protection required an international effort as well as local attention.

In 1922 Pearson toured Europe to study bird protection there. He contacted the most eminent figures in conservation, including Viscount Grey of Fallodon and Percy Lowe of Great Britain, P.G. van Tienhoven of the Netherlands, and Jean Delacour of France. At a meeting held on June 20, 1922 the group concluded that an international organization was needed to promote the protection of birds and their habitats and to address problems that transcended national boundaries. The International Council for Bird Preservation (ICBP) was founded that day.

From the beginning, ICBP's greatest strength has been its member organizations, which now include 272 ornithological and conservation societies from 85 countries. The combined membership of individuals in these bodies worldwide is three million. Wherever practical, member organizations are grouped into national sections whose job is to promote ICBP's conservation priorities at the national level. Today there are 66 national sections. The United States national section includes the Cornell Laboratory of

During a stroll through Manhattan in 1886, an ornithologist counted 542 birds—all of them stuffed and mounted on women's hats. This woman wears egret plumes.

COURTESY NATIONAL AUDUBON SOCIETY


July 14. 1757

The Dodo.

Geo: Edwards, Sculp: A.D. 1757.

294

TOM McHUGH (PHOTO RESEARCHERS, INC.)

The dodo was an easily attainable food source for sailors visiting Mauritius; dodos became extinct in 1681, less than 100 years after they were first discovered. From Gleanings of Natural History *by George Edward. London, 1758. Right: geckos, not birds, are the primary prey of Mauritius kestrels.*

COURTESY HISTORY OF SCIENCE COLLECTIONS, CORNELL UNIVERSITY LIBRARIES.

Ornithology, American Museum of Natural History, American Ornithologists' Union, National Audubon Society, National Wildlife Federation, Smithsonian Institution and the World Wildlife Fund-U.S.

ICBP's far-flung network has been held together by a succession of dynamic presidents, beginning with Pearson. He was succeeded in 1938 by Jean Delacour, a Frenchman who at 94 remains the world's leading expert on the birds of Indochina and on waterfowl, pheasants, and curassows of the world. In 1958 Delacour turned the presidency over to S. Dillon Ripley, then director of the Peabody Museum of Yale University and, since 1964, secretary of the Smithsonian Institution. It was through Ripley's contacts with foreign governments that ICBP and the cause of international bird conservation received a favorable hearing at the highest levels. In 1982, Ripley retired as president and was succeeded by Russell W. Peterson, president of the National Audubon Society, former governor of Delaware and one-time chairman of the United States Council on Environmental Quality.

No history of ICBP is complete without homage to the redoubtable Phyllis Barclay-Smith. From 1946 until her death in 1980, she held the position of secretary and guided the organization from the British Museum of Natural History in London. Miss Barclay-Smith was proud of her nickname, "the Dragon," which she earned by her determination to win her cause. She was one of the first to perceive the dangers of oil pollution and, with James Callaghan, future British prime minister, she created the Advisory Committee on Oil Pollution of the Sea. For her work in conservation Miss Barclay-Smith received numerous medals and was awarded the MBE (Member of the British Empire); in 1970 she was promoted to CBE (Commander of the British Empire).

Today, the need for action on behalf of bird conservation is greater than ever, and ICBP has expanded to meet these needs. In 1980 an executive director, Christoph Imboden, was hired to head a streamlined secretariat now located in Cambridge, England.

In the 60 plus years of ICBP's history, the web of life that supports each species has been revealed as ever more complex; accordingly, conservation efforts have had to become more and more far-reaching. While the feather trade, overhunting, or pesticides have been responsible for the diminution of certain species, the overwhelming threat to birds is loss of their habitat. Habitat destruction is occurring worldwide, but nowhere more rapidly than in the tropics and on oceanic islands. For several years, ICBP has managed projects on two island groups in the Indian Ocean that harbor some of the world's rarest and most endangered birds.

In 1968 ICBP's British national section purchased Cousin Island in the Seychelles, home of hundreds of thousands of fairy, noddy, and bridled terns and of the Seychelles brush warbler. At the time, the 30 brush warblers on Cousin Island were all that remained in the world. Since then, through careful management and restoration of the birds' habitat, the number has risen to 300, and the species is now considered out of danger.

Mauritius is perhaps best known as the home of the dodo. Today its importance for bird conservation is more than symbolic. Three of the world's most critically endangered bird species live on the island: the Mauritius kestrel, pink pigeon, and echo parakeet. Since 1973 ICBP has been working with the Mauritius Forest Service to protect these disappearing populations. For example, the Mauritius kestrel had declined to six or seven birds. While the outlook is far from rosy there are now 10 kestrels in captivity thanks to a captive breeding program, and about six pairs in the wild.

More hopeful is the case of the pink pigeon. This species suffered greatly from destruction of its original forest habitat which has been replaced by introduced shrubs and trees, leaving only 15 to 20 birds in the wild. However, pink pigeons have been bred successfully in captivity and in March of 1984 the first pair of captive-bred birds was released in Mauritius's Botanic Gardens, Pamplemousses in order to increase the wild population of this endangered species.

The echo parakeet is undoubtedly the most endangered bird species on Mauritius. Following a cyclone in 1979 that stripped the fruit off all the trees in the forest, the entire echo parakeet population was reduced to eight individuals. There seemed to be only two females, and there has been no sign of successful breeding for several years. The Mauritius government has agreed with ICBP's proposal to make an all-out effort to catch the remaining birds, since the only hope for the species is to breed it in captivity.

The key to the success of these proj-

PAUL GORIUP

KENNETH W. FINK (BRUCE COLEMAN INC.)

Three presidents: Delacour, Ripley, and Peterson at ICBP's 18th world conference. Hyacinth macaw, left, the largest parrot in the world, is considered threatened.

ects may be a conservation agreement signed by ICBP and the Jersey Wildlife Preservation Trust with the government of Mauritius last March. The agreement recognizes the need for an integrated program to meet the conservation needs of the island's threatened plants and animals and the rapid disappearance of their few remaining habitats. The program is based on the World Conservation Strategy of the International Union for Conservation of Nature (IUCN) and is designed to benefit both the people of Mauritius and its unique wildlife.

In addition to these long-term programs, ICBP presses the conservation cause in other projects all over the world. The most common are habitat surveys to determine the areas remaining for threatened species and to ascertain the number of birds that use them. After each survey, recommendations for protecting the birds are forwarded for action to member organizations or national sections in the countries involved. On occasion, interventions may be made to governments either directly by ICBP or through IUCN.

Surveys also reveal the reasons for the decline of birds when problems are more specific than loss of habitat. For example, research has linked the decline of the Mauritius kestrel to a decrease in the number of geckos, a type of lizard. ICBP researchers discovered that geckos, not birds as previously assumed, are the kestrels' main diet, and that geckos are losing ground because of the invasion of the forests by introduced scrub. Another problem revealed was that many parrots are declining in the wild because of high demand for them in the pet trade. To address this issue, ICBP has worked hard for stricter international trade restrictions, as exemplified by the recently strengthened Convention on International Trade in Endangered Species of Fauna and Flora (CITES).

Greater awareness—on the part of everyone from government leaders to schoolchildren—of the importance of preserving birds and their habitats is essential to long-term conservation success. To this end, ICBP devotes a substantial part of its efforts to educating the public. Technical publications, such as *Conservation of New World Parrots,* are distributed to government wildlife agencies throughout the world. Six more such volumes—on seabirds, island management, tropical forests, birds of prey, cranes, and single island endemics—will be published this year. A new edition, *The African Bird Red Data Book,* cataloguing the status of over 170 threatened African species, will be published shortly. And since field guides arouse an interest in birds and bird watching, ICBP has sponsored guides to several regions of particular importance to birds, including Guatemala, Panama, the São Paulo province in Brazil and the Middle East (in English and Arabic).

ICBP also is assisting in the production of field guides in 10 countries around the Mediterranean where no guides exist in the countries' own languages. Drawn from a list of 96 Mediterranean birds, each country may choose from colorplates and text to produce an identification guide specific to its needs. Chapters highlight conservation and natural history topics such as habitat preservation and bird migration.

Bird migration is an important part of ICBP's recently announced Migratory Birds Campaign, an international issue for which the organization is ideally suited. The thrust of this multiyear campaign, launched jointly with the International Waterfowl Research Bureau, is to promote conservation of migratory species by increasing public awareness of the wonder of migration and the opportunities for international research and cooperation. The campaign will be divided into three sections: North and South America, Europe and Africa, and Australasia.

While much of the conservation news is grim, there are encouraging signs. In some countries, parks and wildlife areas are being designated and protected, endangered species programs are being developed, animal trade regulations and hunting restrictions are being enforced. ICBP hopes that its activities in assessing the state of birdlife, managing rare species, advising governments, and educating the public will help to preserve the world's birds—before it is too late.

FURTHER READING

Halliday, Tim. *Vanishing Birds.* Penguin Books, New York. 1980.

THE AUTHORS

Roger Pasquier was executive assistant to the president of ICBP from 1979 to 1982 and is now with the World Wildlife Fund—U.S. Thomas Urquhart is information officer for ICBP, Cambridge.

NEWS & NOTES

TO THE EDITOR:

In his article on seabirding which appeared in the autumn, 1983 *Quarterly*, Ron Naveen refers to "jizz." The concept of jizz may have some undesirable effects if adopted on a long-term basis by the ornithological community. It may increase incorrect identifications which gloss over complex processes of observation, encouraging observers to neglect the specification of objective criteria, characteristic marks, behaviors and settings. Jizz is not in the bird but in the eye of the beholder since the observer cannot consciously say what elements constituted recognition. Moreover, jizz seems to be a current buzzword. In popular use the term could become muddied and obscured by the overlaying of other meanings.

We must ask whether the disadvantages can be discounted, or if advantages exist to offset them which favor the adoption of jizz.

Nicholas H. Childs and Robert L. Norton
St. John, United States Virgin Islands

NAVEEN'S RESPONSE:

The phrase derives from "G.I.S.," a British military acronym denoting the "general impression and shape" of attacking aircraft. In recent years, some British birders have used the concept to denote the abstract impressions a bird conveys, especially in situations where field marks cannot be readily discerned.

As to the utility of jizz to identify seabirds, let me make some personal attestations. I bird about 1,500 to 2,000 hours per year on the open ocean, where field marks are often rendered superfluous. With the boat rocking in high swells, it's sometimes impossible even to maintain an upright stance. Despite the obstacles, I often can identify a seabird's family (and sometimes its genus or species) by studying its flight style; then, I can concentrate on important field marks. These field marks would be useless if the shearwater I thought I was seeing was actually a gadfly petrel.

A careful observer collects as much information as possible about a rare sighting, irrespective of whether such data are subjective or objective. So, contrary to the suggestion of Messrs. Childs and Norton, I don't equate jizz with the neglect of field marks. With respect to seabirds, jizz aligns the observer in the right direction and allows for using field marks more accurately.

Ron Naveen

THE WOOD STORK has been added to the list of endangered species in the United States. The U.S. Fish and Wildlife Service estimates that wood stork breeding populations have declined 75 percent since the 1930s; only about 4,500 breeding pairs remain. Most of these are in Florida, although a few are in Georgia, Alabama, and South Carolina. The country's largest wood stork rookery is in the National Audubon Society's Corkscrew Swamp Sanctuary near Naples, Florida, where the number of hatchling storks dropped from 13,000 in 1960 to 900 in 1983. According to the National Audubon Society, the species has declined primarily because of human disturbance of water tables through construction of drainage canals and levees, and lumbering of the large cypress trees where the birds nest. The wood stork—sometimes called wood ibis—is the only stork native to this country.

SHOREBIRD COUNTS from anywhere in North and South America are needed by the International Shorebird Survey (ISS), which is compiling an atlas of shorebird distribution. Any counts of shorebirds at a particular site are useful. For more information contact ISS at Manomet Bird Observatory, Box 936, Manomet, Massachusetts 02345.

THE PEREGRINE FUND here at Cornell enjoyed its most productive summer ever. One hundred twenty-four young peregrines were released at 25 hack sites from Tennessee to Maine. More amazing were the 17 wild pairs which raised young in the United States east of the Mississippi. In 1983 only eight pairs produced young in this area; no young were produced there for nearly 20 years, from the early 1960s to 1980. The captive breeding and reintroduction program, begun in 1970 by The Peregrine Fund, has served as a model for many other recovery programs, such as those for the California condor and Philippine eagle.

Dear Member:

Since the early 1900s, laws and treaties have been enacted to protect North American birds: Migratory Bird Treaty Act of 1918, Bald Eagle Act of 1940, Endangered Species Act of 1973. These laws have made it illegal to kill, possess, buy or sell any native North American bird, with a few exceptions. The laws have been effective: with the cessation of market hunting and egg collecting in the early 1900s, populations of many shorebirds, gulls, terns, egrets, and herons have increased from frighteningly low levels.

Yet many populations of North American birds still are declining, for two main reasons. First, while the birds themselves may be protected, their habitats—the areas they depend upon for food, shelter, and water—usually are not. Second, birds ignore political boundaries; although birds are protected within North America, many of them spend a large part of the year in foreign countries, particularly in South and Central America, where laws protecting birds are nonexistent, weak, or poorly enforced.

Some headway has been made in preserving bird habitat, especially for certain endangered species. The Snake River Birds of Prey Area in Idaho, which contains the largest breeding population of North American raptors, recently received federal protection; breeding habitat for the endangered Kirtland's warbler is protected in Michigan, and wintering habitat for the endangered whooping crane is on the Aransas National Wildlife Refuge in Texas. However, preservation of large areas of other habitats—prairies, salt marshes, wilderness lakes, mature forests—is essential if we are to preserve bird populations, even of species that now are not endangered, for example, common loons, American bitterns, worm-eating warblers, red-shouldered hawks.

Some progress is being made on the international front. Most notable are the successes of the International Council for Bird Preservation, the World Wildlife Fund, and the New York Zoological Society. The work of these organizations suggests that there is hope for the world's bird populations. However, our optimism must be tempered by the realization that we live on a finite planet whose ecosystems are intricately linked. Only through sustained efforts on a global scale are we likely to achieve our goal: the preservation of habitats and species in the United States and throughout the world.

CHARLES WALCOTT, *Executive Director*

RESEARCH & REVIEW

Richard E. Bonney, Jr.

EACH YEAR dozens of books about birds are published, and sometimes it's hard to know which are worth owning and reading. Here is a list of some of the best bird books in print. They have been selected using several criteria: readability, technical accuracy, comprehensiveness, and appeal to a wide audience. The list is far from exhaustive—numerous excellent books are missing, particularly technical books, books of regional interest, and those about specific groups of birds, such as shorebirds or warblers. Also missing are classics that are out of print. All the books below should be available or can be ordered at any good bookstore.

A FIELD GUIDE TO THE BIRDS EAST OF THE ROCKIES *by Roger Tory Peterson. Fourth Edition, 1980. Houghton Mifflin Company, Boston. 384 pages. $15.00 (cloth) $11.95 (flexibook) $10.95 (paper).*

A FIELD GUIDE TO WESTERN BIRDS *by Roger Tory Peterson. Second Edition, 1961. Houghton Mifflin Company, Boston. 309 pages. $12.95 (cloth) $11.95 (paper).*

Fifty years have passed since Peterson wrote his *Field Guide to the Birds*, the first popular guide to identifying birds by using field marks. Despite other guides that have appeared over the years, Peterson's eastern guide—along with its western counterpart—is still the best.

Its illustrations are accurate in terms of color, shape and field marks. Many birds are shown in immature or juvenal plumages and in flight, and similar-looking species are grouped on plates so the species can be compared readily. Bird sounds are described in understandable terms, and behaviors, such as tail pumping or head bobbing, are discussed when they aid identification. Range maps, which depict the distributions of individual species, are large and detailed and indicate state boundary lines (the current western guide has no maps). Because the continent is treated separately in two volumes, eastern birders are not confused by illustrations of western birds, and vice versa. Furthermore, the guides are compact and can be carried easily; the paperback versions weigh just one pound.

FIELD GUIDE TO THE BIRDS OF NORTH AMERICA *edited by Shirley L. Scott. 1983. National Geographic Society, Washington, D.C. 464 pages. $15.95 (paper).*

This field guide is Peterson's closest competition. In fact, it may be preferred by advanced birders because it is more comprehensive and more detailed. It contains all the birds that breed in North America plus numerous visitors not included in the Peterson guides, and depicts more birds in seasonal, immature, and juvenal plumages than does Peterson. However, beginners probably will find the book overwhelming because of all the illustrations. Also, many of the illustrations are inferior to Peterson's, and the book is uncomfortably large and heavy for use in the field.

THE AUDUBON SOCIETY ENCYCLOPEDIA OF NORTH AMERICAN BIRDS *by John K. Terres. 1980. Alfred A. Knopf, New York. 1,110 pages. $60.00 (cloth).*

If you could own just one book besides your field guide, this tremendous volume would be the best choice. It is the most used book in the Laboratory of Ornithology Library and is worth every penny of its price.

The book discusses 625 ornithological topics from albinism to zoonosis and defines 770 ornithological terms from abmigration to zoogeography. It also includes species accounts (biographies) of 847 birds and is beautifully illustrated with 875 color photographs and 800 black-and-white drawings. If you're looking for specific information, cross-references make obscure topics easy to find. Terres gleaned his information from thousands of books and periodicals, and the encyclopedia is carefully referenced with an extensive bibliography.

BIRDS OF THE WORLD *by Oliver L. Austin, Jr. 1961 (reprinted 1983). Golden Press, New York. 319 pages. $24.95 (cloth).*

This oversize book is a survey of the world's orders and families of birds. What makes a parrot a parrot? What do the passerines have in common? How do creepers differ from nuthatches? This book explains the general characteristics of all bird groups in a nontechnical manner and describes representative birds of each. The book is attractively illustrated by Arthur Singer and provides an enjoyable way of learning about the many fascinating groups of foreign as well as North American birds.

A GUIDE TO BIRD FINDING EAST OF THE MISSISSIPPI *by Olin Sewall Pettingill, Jr. Second Edition, 1977. Oxford University Press, New York. 689 pages. $15.95 (cloth) $7.95 (paper).*

A GUIDE TO BIRD FINDING WEST OF THE MISSISSIPPI *by Olin Sewall Pettingill, Jr. Second Edition, 1981. Oxford University Press, New York. 783 pages. $25.00 (cloth).*

Here in two volumes are descriptions of some of the best birding locations in the United States. For each state an introductory section describes major physiographic features, such as rivers and mountains, and the plant and birdlife found in each. The introductions are followed by descriptions of specific birding areas, including lists of expected species and directions from a major road. The indexes include names of bird species, so good locations for particular species can be found quickly. Since Pettingill covers the entire country his area descriptions are brief, nevertheless, the books are excellent as a single source of information about the country's best birding locations.

A GUIDE TO BIRD BEHAVIOR *by Donald W. Stokes. 1979. Little, Brown and Company, Boston. 336 pages. $14.95 (cloth) $8.95 (paper).*

A GUIDE TO BIRD BEHAVIOR, VOLUME II *by Donald W. Stokes and Lillian Q. Stokes. 1983. Little, Brown and Company, Boston. 334 pages. $14.95 (cloth).*

Are you a birder who wants to go beyond listing the names of birds and learn about bird behavior? If so, these unique books will be a big help. Each volume discusses the behavior of 25 common species, one to a chapter, with each chapter divided into four parts.

First is an introduction to the species' behavior. Second is a calendar that shows the general behaviors, such as courtship and migration, that occur each month. Third is a display guide that describes and explains specific visual displays, such as bill-waving, crest-raising, and wing-fluttering, and auditory displays, such as songs, chirps, and chatters. Finally, detailed descriptions are given for behaviors associated with territorial defense, courtship, nest building, breeding, plumage, and seasonal movement.

BIRD SOUNDS AND THEIR MEANING

by Rosemary Jellis. 1977. Reprinted 1984 by Cornell University Press, Ithaca, New York. 256 pages. $14.95 (paper).

For an excellent introduction to the subject of bird sounds, read this informative yet engaging, nontechnical book. Jellis explains the meaning of the different kinds of bird sounds and the contexts in which they are made. She also discusses local variations in a species' songs, called dialects; birds that imitate their neighbors, known as mimics; the evolution of songs, and much more. Most of Jellis's examples are of British birds, but the concepts she describes apply to birds worldwide.

BEYOND THE BIRD FEEDER

by John V. Dennis. 1983. Alfred A. Knopf, New York. 201 pages. $14.95 (cloth).

Unlike the Stokes book, which discusses specific behaviors of individual species, this book is an easy-reading treatment of general topics of bird behavior. Dennis explains the impetus behind migration and the many factors that determine feeding behavior, such as food color and availability. He discusses the methods birds use to elude enemies such as protective coloration, alarms, and mobbing. He describes how birds avoid confrontations with others of their kind, such as by flocking and maintaining pecking orders, and the ways birds induce confrontation, such as thievery. He explains why birds bathe in water and ants, and describes the effect of weather on birds. The book is written in a chatty, anecdotal style that provides a painless way of learning about many interesting facets of the birds' world.

A COMPLETE GUIDE TO BIRD FEEDING

by John V. Dennis. 1975. Alfred A. Knopf, New York. 288 pages. $15.95 (cloth).

This book is designed primarily for use east of the Great Plains but the techniques described can be applied anywhere. Dennis explains the types of feeders, what to put in them, and where to place them to attract a wide variety of birds. He also explains how to deal with problems, such as feeder-dominating squirrels and birds striking windows. A large part of the book is devoted to methods of attracting specific types of birds, including hummingbirds.

Stokes discusses the behavior of familiar bird species including the barn swallow.

LINCOLN NUTTING (PHOTO RESEARCHERS, INC.)

THE LIFE OF BIRDS

by Joel Carl Welty, Third Edition, 1982. CBS College Publishing. 754 pages. $29.95 (cloth).

Many colleges use this excellent text in their introductory ornithology courses, nevertheless, most of the book is easy to read and can be understood by anyone interested in birds. Welty presents basic bird biology in a logical and straightforward manner, keeping technical terms to a minimum. The book contains detailed treatments of bird anatomy, physiology, behavior, ecology, evolution, nesting behavior, flight, migration, and distribution.

AVIAN ECOLOGY

by C. M. Perrins and T. R. Birkhead. 1983. Blackie and Son, Ltd., Glasgow. 221 pages. $19.95 (paper).

The advanced undergraduate and serious amateur are the intended audience for this fairly technical text. However, it is clearly written and provides the best—in fact, the only—comprehensive and up-to-date treatment of bird ecology available. It covers territoriality, coloniality, breeding systems, population regulation, interactions among bird species, foraging behavior, and migration. The authors attempt to explain why various behaviors have evolved and how they help birds survive and produce healthy offspring. Because the book was written by British ornithologists many of the examples are of European species, but the ecological principles discussed are the same everywhere.

THE ADVENTURE OF NATURE PHOTOGRAPHY

by Tim Fitzharris. 1983. Hurtig Publishers Ltd., Alberta, Canada. 216 pages. $19.95 (paper).

Here is an instructive book on nature photography by Tim Fitzharris, a superb photographer whose work appears frequently in *The Living Bird Quarterly.* Fitzharris excels at bird photography and, while the book deals with all types of nature photography, many illustrations and examples relate to birds.

The first part of the book addresses the mechanics of nature photography, and is full of information on selecting equipment, equipment maintenance, camera operation and photographic technique, and picture composition. The second part offers tips for approaching birds and other wildlife, particularly by the use of blinds; a chapter is devoted to photographing birds at the nest and in the field. This detailed book should be useful to both novice and advanced photographers.

An Old-fashioned Background

Frances Hamerstrom, 1919

Frances Hamerstrom

BIRD WATCHING—for me—tends to be with a purpose. As a child in Massachusetts, I used to borrow my mother's pearl-handled opera glasses and climb high into the tops of the oaks and hickories to see what the warblers were doing. My favorite oak held a small pool in a hollow crotch high above the ground after each rain. I found myself a perch still higher so I could look down at my pool and watch the birds come to drink. They sometimes fought and—as I watched them day after day—a pattern developed. Some birds were king and could have the pool any time they wanted. Others fought for their turn at the pool, and still others slipped to the pool only when no other birds were around. I wondered why. Were certain individuals more domineering?

A screech owl roosting in a rhododendron was discovered by a blue jay, and more and more jays came screeching and diving to mob it. As far as I knew nobody had ever watched anything like this before. This was the day I started to write my first bird book. Chapter 1: How the jays hated the screech owl. Other chapters followed. Knowing nothing about plagiarism, if I found a good chapter for my book in a magazine, I cut it out and pasted it in. Sometimes I pasted my own handwritten account right over someone's published story, convinced that mine was right and his was wrong. In retrospect I now see I was beginning to make progress as a scientist, for I no longer believed everything that was printed . . . a valuable lesson that some grown-ups have not learned yet.

My early problems with bird identification were stupendous. The only book I owned that could help me at all was *The Look about You Nature Book.* It was beautifully illustrated with vivid colored pictures; but this charming volume was British, and no one pointed out to me that the birds of Great Britain are not the same species we have in the United States!

I kept my birding increasingly secret. I hated being laughed at whenever I called crows "rooks" or referred to chickadees as "tits." Besides, before long I managed to get a BB gun and started collecting birds. This came about after my governess took me to a museum on one of our daily walks. She let me take a dead bird (found by the roadside) with me for identification. The men in the museum were delighted. They praised me and showed us the workroom where they stuffed birds in lifelike positions. A hunchback was putting the final touches on an exquisite thrush standing on a twig and singing with its mouth open. I leaned so close to see better that one of my long braids fell over his shoulder. He grunted and pushed me aside. I apologized and my governess took me away. It would have surprised me even to suspect that the hunchback and I were about to become fast friends. What I did know was that I needed dead birds for taxidermy, and for a way to get back to this wonderful Ward's Natural History Museum in Hyde Park—just a mile from our house. It never occurred to me that they might let me in the door even if I had the temerity to arrive without at least one dead bird.

Thereafter I visited the museum alone, escaping from adult supervision on my bicycle. Something told me that my family would not understand if they found out 1) that I had a gun and 2) that I had a hunchbacked friend who traded me glass eyes for birds I mounted for my private collection in exchange for specimens of rarer birds the museum wanted.

I learned to identify the birds of Massachusetts by wandering around in that museum studying labeled specimens and I felt it my duty to supply them with as many specimens of the birds on their want list as I possibly could.

My family graciously gave me a vacant maid's room for my hobbies. It contained my insect collection, my egg collection, arsenical soap for preserving skins, and things that I just happened to like: for example, a doll's bureau with a secret compartment for hiding small objects. Dolls were not a part of my world.

If my parents had wished to foster my passionate interest in natural history—and they did not—they would have discovered that we lived only three miles from the Brush Hill Bird Club and would have enrolled me as a junior member. It was my great good fortune *not* to learn of the Brush Hill Bird Club. Perhaps I'm unfair, but I have a sneaking suspicion that they would have dissuaded me from my private collections, my gun, and perhaps even from my personal wild animal hospital to which our neighbors brought injured creatures for me to nurse back to health. Among these injured creatures was a kestrel. I nursed her and recognized that she was a falcon, so I read all the books I could on falconry. I trained her until she took English sparrows day after day as they went to roost in the ivy on the church.

The period, 1915 to 1925, was a time of transition in American ornithology. Bird clubs were forming and for many people birding was becoming a pastime. By some fluke of fate I found that the direction my life was to take was spelled out by the time I was 15. Later, as an adult, I published technical papers on all the subjects that I have touched on.

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C. KARSTAD '87